atomic
MAXIMUM POWER COMPUTING

www.atomicmpc.com.au   Proudly Australian   Issue 31   Aug 03

atomic 31

$6.95

FUTURE PC
MEMORY OF TOMORROW
FROM DDR400 DUAL CHANNEL TO HOLOGRAPHIC HARD DRIVES

Big-arse graphics 256MB DDR II RADEON
Death rays Is your PC killing you?
The look-at-me PC Water-cooled, see-thru glow box
Game sound FAQ Bang boom whack
Pocket monsters Game Boy grows up

win! The sexiest PC box on the planet

The wait for the greatest games of 2003 is almost over >>

capcom-europe.com

Contents

AUGUST 2003
ISSUE 31

> Subscriptions 096

A Warcraft 3 expansion means time becomes important. Our scienticians have calculated that having *Atomic* delivered to your door may give you 2.8% more Orc walloping time.

> I/O 086

Your tech problem is like a giant tongue. *Atomic* is the worlds biggest 9 Volt battery. I/O is where the two meet and the twitching occurs.

> Phr33x Tw33x 089

Stop your hard disk sounding like ball bearings in a milkshake machine by managing memory properly, or tweak your UT2003 to glory.
Here is your one stop shop for nuggets of tweakeriffic goodness.

> Modjitsu: The Soggy Polymer Project 090

Hot, wet and wrapped in plastic. That is Ron Prouse's sublime end point to this month's sacrifice to the gods of case modding.

> Competitions 095

Answer a question. Win cool stuff. Why are you still here?

> Fallout 098

Does the sound of *You're the voice* bouncing in polyphonic glory from a mobile phone freak you out? John Simpson is here to help ease your pain.
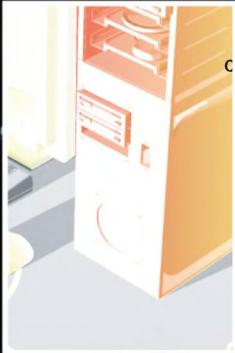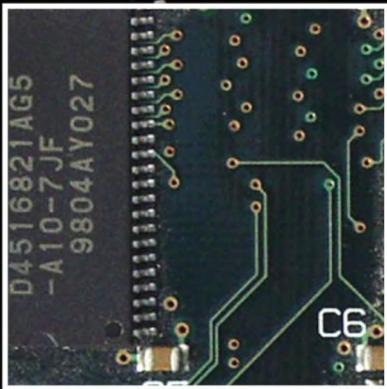
> H2H: Memory madness 028

DDR-400 is finally available for your speedy needs. Nathan Davis looks at the schism between the nomenclature and the actualisation of DDR.

> Feature: Silent Emissions 034

Wondering where your third arm came from? Curious about the tingling feeling everytime you lick your case window? Ty Pendelbury exposes the hidden RF dangers of tech love.

> Feature: The Hard Drive of Memory 040

In the far future data will be stored in the brains of genetically engineered pocket midgets. But in the interim Dr. Carlo Kopp looks at the next generation of storage.

Slap me happy

In some parts of the world, the *Atomic* sticker is currency. Like at LANs. Most Mondays I get a couple of friendly emails from gamezOrz who have been to a LAN over the weekend, usually their first, and spotted the omnipotently coolest cases there – being the ones with *the Sticker*. Understandably, they want some of that stickery action.

Quite obviously, the Sticker's transparentness brilliantly serves to add gleam to whatever colour of casing you choose to have stucken the sticker to. It's really very cleverly designed. Largely polymer-based, with a little touch of magic, the *Atomic* Sticker has been applied to an amusing variety of surfaces in the past. Breasts and buttocks spring immediately to mind, as do security guards and police stations.

Really though, it's up to you. Yes, you. Because, it's *your sticker!* Yes, in a particularly incandescent *Atomic* initiative – we're giving 'em away! Wow! All you have to do is subscribe or renew your subscription! [crowd sighs deeply, saw that one coming a mile away Ben.]

Yes, from now on, at least until we run out of stickers, (which is ages away, and probably much longer than that, because we'll just get more made) – whenever anyone subscribes to *Atomic* they automatically get stickerage. Samo if you renew your subscription – expect free sticker action coming your way. Hurrah!

If you're not a subscriber, simply turn to *page 96* and get cracking. Observe too, please, on that same page, the neato Soggy Polymer Project, which you can win if you subscribe or renew. No doubt you'll be slapping an *Atomic* sticker on that baby faster than you can say 'slap me happy, yeah!'

In other great subscriber news, from last issue onwards (in case you hadn't noticed), just by being a subscriber you are in the draw for *great prizes!* Page 95 has all the juice for that. It gets better and better! How great is all this?

Perhaps it is as great as that golden time when we increased the cover price of *Atomic,* all those months ago, *but* left the subscriber price at its low low level? Ah, those were the days. I say that in the past tense, because those days are over. Yep, the unfeasibly low subs price has been overtaken by economic reality. Starting with this issue, the price has crept up a virtually insignificant $10 for a 12-month sub, and a relatively paltry $15 for the full-blown 24-month fanger. That's still a big saving over the newsstand price, so, er, stickers! Eh!

Now that I've smoothly introduced that news, here are two more *Atomic* introductions: Over at Hot Box, we have a new sponsor! NVIDIA has come onboard for the full 12 months. That means choice prizeware each month, and a majorly huge prize for HotBOTY in 12 months! Good one NVIDIA. Great to see those guys backing the modders. So, come on and send in pics of your box, or get modding and get creative and get into it. Send me pics at hotbox@atomicmpc.com.au.

And, in the *real* big news of the month, it's a warm and excited welcome to our new guy, Nathan Davis. From Nathan you'll be copping the same wisdom and tech wizardry which is *Atomic,* delivered with rich insight, fruity humour and a rare and special personal style which will have him winning us awards in no time. Wontcha Nathan. . .? He kicks off his first issue with a blinder of a memory feature. It nearly killed him. But he's fine now. Aren't you Nathan? Eh, Nathan. . .?

And now, the magazine. Proceed.

Ben Mansill
Editor

◄ Intel's strategy of splitting its latest chipsets into the high performing i875P and mainstream i865 series is beginning to backfire. The main advantage of the i875P is Performance Acceleration Technology (PAT). However ASUS recently announced it had PAT working on the i865, which was then followed by a horde of other manufacturers like MSI, ABIT and EPoX announcing that they had PAT support as well. Intel isn't happy of course, because these developments have seriously undermined the i875P cash cow.

◄ Two interesting Xbox 2 rumours recently emerged. Steve Ballmer was quoted in a Japanese newspaper (that later denied the story) as saying that the unnamed Xbox successor would launch in 2006 and rumours started firming that ATI may have the inside running over NVIDIA for designing the console's graphics. Unsurprisingly Microsoft's response to these rumours is that no date has yet been announced for future Xbox products and services.

◄ Cheaters suck. Not only do they ruin it for the rest of us, but we want to smash their retard faces against their desks until the wood splinters. OzForces feels exactly the same way. In a gutsy move, it's decided to ban anyone discovered cheating. Gutsy, because OzForces is an ISP as well as a gaming network (just over 200 servers at last count). So when it kicks a cheater, it could loose an ISP customer too. Suck that down cheaters! OzForces uses its own Tarantula software to automate the process of uncovering cheaters, no matter how smartypants they think they are.

NEWS
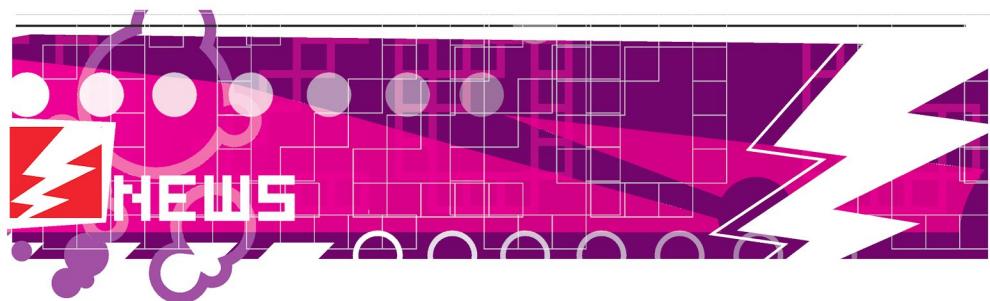
Game and watch

Want your name up in lights? Or perhaps just a name you've created?

Everyone likes a good dose of LAN-nage every so often. All the Internet multiplayer action in the world cannot replace the thrill of kicking the arse of the person sitting next to you. It's just unfortunate that so much crap goes along with LAN attendance, waking up early, packing your PC into a car while trying to remember every bit of cabling, reinstalling Windows when your system refuses to work with the network, realising that while you remembered all the cables, you left your Windows CD on the kitchen table. . .

Ok, so there are a few downers to going to big LAN events. You can bypass most of these by heading out to a LAN café, but these places generally have 20 PCs at the most, which is fun for a quick game of Counter-Strike, but lacks the big numbers that make LAN events so much fun.

Lucky Sydneysiders will soon have a chance to experience the best of both worlds, with a new gaming café opening in the bowels of the city's George Street Cinema complex. Run by iStarZone, who's been around since 2000 and already operates two other places in Sydney, this venue is pretty darn big. With over 80 PCs, café section and iStar technology shop where you can grab the latest hardware and games, it's the place to be in Sydney for all things computer-related.

The gaming action is broken up across several areas. Firstly there is the *Atomic* Arena and the AMD Arena. These are rooms with 20 PCs in each for intense group gaming. For the intensity of clan matches there's a dedicated clan area designed so teams can compete in a regulated environment.

If you want a bit more privacy then there are VIP rooms, which sport premium PCs for frame whores everywhere and also a of couple rooms where you and your loved one can sit back on a couch and engage in a bit of tank rushing without being rudely disturbed.

It's more than just somewhere to game, it is a shrine of gaming at which to worship. While the unwritten rules of science mean that the discoverer should have naming rights, calling it St. Carmacks Cathedral was never really a goer. So instead the crew at iStarZone has come up with an even better idea, get those who know gaming to christen it.

So here is your chance to invent a name that will echo through the ages, to make your mark on the future history of gaming in Australia, to drag your friends to the movies then accidentally notice the café and loudly tell them that you came up with the name. All you need to do is invent something smart and snappy, something that encompasses the gaming splendiffery contained within.

If you're the lucky denominator you'll win a years membership at the cafe. Plus you'll also be the owner of a mint-condition warm fuzzy feeling every time you see the fruit of your mental labours emblazoned on the front of the venue.

For your chance to win, jump online and go to www.atomicmpc.com.au, where you will find all the details you need for your shot at gaming immortality. Entries can be sent to istarcomp@atomicmpc.com.au. The competition closes on the 31/7/2003.

AUS EGAMER

National competition dominated this month's Esports news with the inaugural Esports World Cup Qualifier in QLD, with each team pre-qualified in their respective states. A last chance comp was held for clans that had not qualified. This drew the likes of BDI winners Naughty Kommandoz and TB regulars Validus and Zealot. The final placing saw nK on top followed by Tsi and Validus. The morning saw the first rounds open with some surprising results. Former Aus WCG reps, Ichor, met a 13-6 defeat against in-form rivals Function zerO, slipping into the lower bracket. Continued play saw clans fO and Everglide plow through the field with a surprise early exit from CA.l337 sponsored Xtreme Revolution. Function zerO secured a smashing 13-3 win taking out the winner's bracket to force Everglide into a semi-final showdown with Ichor. Everglide quickly dispatched of Ichor to meet fO in the final. The game was never really in doubt with a crushing 13-2 win to fO on de_dust2. Function zerO now fly to France in July to compete against the world's best. By the time you read this they will already have competed, so let's hope they put on a good show. Good luck to the fO crew. Other news this month saw The Bunker Gaming League season 2 draw to a close with fO taking out Division 1, Random Task taking out Division 2 and Neurosis taking out Division 3. On the Warcraft 3 front, the ESWC-au nationals were played through LAN cafes in each state with Raggy narrowly beating Glade in the final. That's all for this month's news, but remember to check www.cyberagecafes.com for competition around Melbourne next month and a whole lot more. GG to INKinnear, a fscking champ.

Stuart Denham

The Hulk who wasn't there

In their final cinematic outing, Kevin Smith's Jay and Silent Bob characters take off and travel around the country, proceeding to beat the crap out of all the movie nerds who slagged them across various Websites. It is a poignant scene, transcending film and getting to the heart of what the Internet can be for so many people.

Let's hope the latest victim of Internet movie fervour doesn't follow a similar path of retribution. Two weeks before it opened in cinemas, a pirate version of *The Hulk* leaked out onto the Web.

This is not a new phenomenon, having occurred with movies such as *Spider-Man* and more recently *Matrix Reloaded*. However this time there was an unfortunate twist.

The high quality version of *The Hulk* that hit file sharing networks such as Kazaa and Bit Torrent was an incomplete 'work in progress' copy. The whole movie was there, but ILM had not completed work on the CGI that plays such a crucial part in the movie, and it was this craptacular version that was distributed.

Sufficed to say, a whole lot of people got pissed off, all the way from the vocal Netizens who slammed the movie for its crap CGI (comparing the look of *The Hulk* to *Shrek* was a popular tack) to Universal, who has been banking on *The Hulk* being a major blockbuster.

Frankly, it exposed a lot of idiots as well. Watching people slag the movie off even though they acknowledge that a major aspect is unfinished is a beautiful lesson in the inherent stupidity of some people. No wonder Universal was so enraged by the negative publicity – the leak had the potential to poison people against it.

Fair enough, if a movie sucks then say it sucks, but at least wait until the damn thing is finished. ○

atomican

Battle@Matchrix IV has come and gone, regrettably the great and noble armies of Atomica were defeated by the Order of Challengingly Amazing Underpants –I mean Overclockers Australia, OCAU. Despite defeat at Vietcong and Desert Combat, Team Atomic was able to save face with a resounding victory in Quake 3. While OCAU now holds a 3-1 lead in the series, the main thing was that everybody had a great time and two communities were able to get together and have some good gibing fun.

Even though the hazy, wavy effect is not included, QuadLex has provided some kind of temporal mind vortex to the past with his Atomic Reminiscing thread (www.atomicmpc.com.au/forums.asp?s=1&c=1&t=13913). For those who can remember the 'good 'ole days' when the only reason the server went down was because shwerdman tripped over it, and posting a topic was more like a game of Russian Roulette to see where it would end up, it's a great flashback to the ghosts of *Atomic* past.

Coming to a road near you, some time in spring, is the *Atomic* Road Trip. Camping out under the stars, kicking it back without the hustle and bustle, spending some time away from in front of the screen will all be on offer. If it sounds like a good idea, drive on over to forums.asp?s=1&c=5&t=179 to begin the journey.

DementedFreak seems to have some kind of fetish for hair (or lack thereof). Whether it be on a well endowed or inadequately covered Atomican, almost no follicle is safe from his photoshopped grasp. Just look at forums.asp?s=1&c=1&t=11882 and forums.asp?s=1&c=1&t=14000 and you'll see what I mean. I wonder what Freud would make of all this?

If you're in the market for any kind of computer hardware, it's more than likely that there is already a Price Watch floating in the tech forums somewhere for what you need. Updated regularly, they are a great asset for Atomicans trying to get the most holler for their dollar.

As always, remember that velure makes really snappy uniforms, and has a particularly nice feel to it.
Wilkshake

POTM 31

Rarely has a person of such humor, character and relentless dedication to his belief graced our forums. This award should really be for 'Presence of the Month' as our winner came from nowhere and every post he made was pure gold. But, following guidelines, we're obliged to give it to one post, so we've chosen the one he started his opus thread with: 8x fsaa on a 3dfx VooDoo 6000 at 60fps -eat ya words boys. Find it at:

http://www.atomicmpc.com.au/forums.asp?s=2&c=7&t=1863

ElvISAlive –you rock. Ignore the critics and stay with us. Stay with the Voodoo 6000 you bought on eBay and stay with your three-year old games running '8x FSSA'. Most of all, stay with the 3dfx dream. Bravo ElvIS –you score the MX700 from Logitech, although, I suspect you prefer the rare Intellimouse White. Enjoy!

WHAT'S HOT

- IGP –ATI and NVIDIA's chipset joy
- Memory –Umm. . . I had it a minute ago
- Holodisc –Tiny data warehouse
- Frozen Throne –Late night heaven
- Apple G5 –Nice specs

WHAT'S HOT

- Extreme Graphics –Intel's integrated sloth
- Memory –What are we talking about?
- Holodeck –Big empty room
- Cold Toilet –Early morning hell
- Apple G5 –Bad SPEC

Information ubiquity

In the future, bits and bytes will be like tears in the rain (thank you Rutger Hauer) – all pervasive, ever present, indistinguishable from the natural world. Or so says Ashton Mills.

Despite the times we live in and the rapid progress of technology, we are still in the stone ages in respect to the influence of tech on our lives. We think we have dependence on technology now, but compared to what's coming we might as well be living in caves.

The undeniable advantage of computing technology is the storage, manipulation, dissemination and distribution of information. Moreover, doing this with speed and efficiency at low cost. These are the factors that shape the technology of our lives.

Partly realised is that these factors allow us to streamline our lifestyle – we have automated home appliances, computer controlled cars, online shopping, worldwide access to our bank

Everywhere you go and everything you do will have bits associated with it.

accounts, instant wireless communication and more.

Partly unrealised is just how far these factors will take us. We can't begin to fully comprehend the possibilities and scope that the technology allows for our future. However, now we can see how these key factors shape emerging technology and the devices and services they create.

Take the concept of personal identity. Who needs credit cards, cash, PDAs or phones when you can wear a single device that does all of the above? A wearable personal computing unit (PCU) will handle all of your needs, from cashless shopping through to biometric identification by your house and car, or real-time, high quality, video communication to anyone anywhere in the world, replete with GPS positioning.

Everyone will have one, like a pair of jeans. Its long life batteries will be topped up by kinetic energy as you walk around with solar panel threads weaved into your jackets. A night out clubbing will kill your brain cells while charging your gear's battery cells.

When you go home you'll be greeted by automated entertainment, lighting, and message systems tuned to your likes and

plugged into a nation-wide network providing far more services than simple TV and the Internet. The beast powering your house will communicate with all devices and your PCU through wireless embedded in the walls, and it'll be hooked up to a massive computing grid to share its idle load for the benefit of the state-wide suburban services. Scientists might lease processing power from the government tapping into the grid to perform research and so on.

Hackers will mod their gear to block the incessant advertising from corporate junkies riding the massively marketed wave of location-based advertising. They'll bypass DRM protected content, and make use of the computing grid and Internet in many innovative ways their creators and content authors had never dreamed possible.

Open source will run the grid, as it runs the Internet, and closed source software will be relegated to niche markets, military and industrial use, and cutting edge business software. And games, massively multiplayer persistent worlds, served into every home, will become a primary pastime for a generation weaned on them.

Everywhere you go and everything you do will have bits associated with it. Who you are, what you're worth, what you like and dislike, where you live, what you do, who you love, the very interactions you have with people in society will all be through converged devices sharing information across networks, across systems, and ultimately across the world. How we live and how we define ourselves will almost completely be encompassed in bits and bytes, with wireless being the embryonic liquid in which they flow. Everything about our lives will be structured around the flow of binary information.

And it's not all that far off. The basis of the devices that will provide information ubiquity are coming together now. Foremost is the storage and

distribution facets, the basic enablers of all these technologies.

For cheap, low power, fast and non-volatile storage we have carbon Nanotube RAM (NRAM), Magnetic RAM (MRAM) and holographic storage, all of which will start to appear in the next few years. It won't be long before your laptop becomes truly instant-on – imagine your desktop appearing before you've even finished raising the lid.

Public wireless access points are already starting to appear, and it's a certainty that wireless will become the defacto standard for all office and home networking. Some cities in the US are already planning blanket wireless coverage, so you can walk from your house with a laptop or PDA to a cafe, to a park, and to a shopping center and never miss a beat.

Paris is already trialing cashless smart cards, allowing Parisians to buy services and goods with a single integrated card.

Cars on the drawing board are being designed with a move to higher voltages to support the ever-increasing integration of electrical devices, including computers, and for laptop users on the run portable fuel cells will be available

Was he a replicant? Will we ever know the truth? It has to be one of the biggest debates in sci-fi history – it's right up there with 'Is time travel possible?' and 'Do androids dream of electric sheep?' Alternatively, it could all be the machinations of geeks who can't accept things at face value. Why is it so deck 'ard to see?

next year, allowing you to walk in and top up the supply at the local 7-11.

While we can guess the type of future we might have in a world where the flow of bits is as natural as the flow of air and water, just how the key facets will affect us socially is much harder to predict. But one thing is certain, it will all be about information ubiquity, and those who will be intrinsically linked with it. Inseparable, like it had always been in existance.

Speaking of which, kudos and 1337 glory to those who know the source of the tears in the rain reference. Perhaps that, too, is in our future.

Self-induced nightmare

It should be easy. But it never is. Especially when you think it should be easy and you forget it never is. Is it Tim? Dean.

I've finally done it. I've finally upgraded. I've finally ditched the old P3 800MHz I had kicking around running on a BX motherboard, originally the base of my old P2 450MHz from back in 1998. I can't believe it's taken this long to get around to it. I guess a combination of having a lot of kit to play with at work, and a car that sucks money direct from the folds of my wallet has prevented me from making the move sooner. But now it's done.

It wasn't easy. It was, in fact, deceptively complicated.

I now have a brand spanking P4C 2.4GHz on an 875 mobo with 512MB of DDR400 running dual-channel. A bit of woggling, and it's now running at 3GHz on stock cooling – and when I get around

> **". . .dawned like 5.00AM on New Year's Day, where the grandeur of the scene is matched only by the pall transpiring in your body as the lingering effects of alcohol give way to a hangover. . ."**

to grabbing a better HSF, I'll see how much higher I can push it. It's really only the beginning.

So now, I'd like to take you on a little journey. A journey of discovery. An adventure, if you will, in upgrading, frustration and insight. And maybe somewhere along the way we'll learn a little something about ourselves. Just like *Doogie Howser*. You know – the little things he puts in his diary every night. 'March 5: Learned a lesson. Made a friend.' Just like that.

It all started when I brought the CPU, RAM and mobo home, put on a pot of coffee, chucked on the radio (an unusual sensation, but I couldn't listen to MP3s as I normally do – for obvious reasons), grabbed my trusty *Atomic* tool kit, uttered a small prayer to Zoroaster, drew a mini-mandala with the leaves in the courtyard for luck and made sure my case was pointing towards Mecca just to be sure.

I did the usual backups before performing an upgrade – by which I mean, I backed up a couple of files, but got bored and decided it should all work, and gave up. I was confident, perhaps in retrospect too confident, that things would be easy. Far out. It really is

amazing sometimes how many times it takes to learn a simple lesson.

So then I popped the lid, whipped out the old mobo, CPU and RAM, then hoiked them in the corner. In went the new mobo, and here I came up against Stupid Mistake #1. In fact, it's so stupid, it's a bit embarrassing relaying it. Made even more so by the fact it's not the first time I've made this mistake.

Yep, I left the ports back plate off. So, out with the mobo, in with the back plate, and back in goes the mobo.

Heh, I laughed to myself, how about that? Glad no one saw me do it. At least it's the obligatory silly problem that happens with every upgrade out of the way. Unfortunately, this was not the case. There were plenty of other problems just around the corner.

Once everything was in place, and it was almost time to fire it up, the next problem dawned on me – dawned like 5.00AM on New Year's Day, where the grandeur of the scene is matched only by the pall transpiring in your body as the lingering effects of alcohol give way to a hangover of Homerian proportions.

I forgot I had an old ATX power supply – and it didn't have one of those bloody 12V P4 connectors. Yay.

So, it was either a new PSU, or a new case. Or even better, a $6 adaptor cable. So it's off to town in the money-guzzler to grab a cable. 40 minutes later, and we're back in action.

Then the real fun started. You know, sometimes I wonder how I manage to make a magazine every month, let alone get out the door each morning wearing pants. See, I also forgot I had a 250W PSU – which is now coupled to a P4, two sticks of DDR RAM, a GeForce4, three 10,000rpm SCSI drives, a DVD-ROM and a CD-R. Not to mention those little blinky lights on the front of the case – I'm sure they just suck down power.

Of course, all this meant that depressing the power button on my case gave me about a 30 percent chance of

ignition. And power would rarely last more than five or 10 minutes anyway. Now I really did need a new PSU.

Thankfully John had a spare 300W number lying around. So an hour, and a curry for lunch later (John lives very close to a number of very reputable curry establishments, and it would have been criminal for me to drive up that way and not consume a bit of vindaloo), I have the PSU in hand.

Once that's in and done, things were starting to look better. I even managed to boot to Windows, and let XP detect all the new chipset drivers, before I made my next fatal error.

I installed the Intel Application Accelerator. The word genius didn't even begin to describe what I wasn't feeling like at the time.

You see, the IAA isn't compatible with the 875 chipset. But bugger! How was I to know? I just popped in the mobo CD and installed all the drivers in order. I wasn't thinking at the time. Didn't think I had to.

And bang. Or shall I say: And blue.

I suffered a blue screen of death on a magnitude the likes of which haven't been seen since monkeys descended out of trees and started burning things.

No amount of fixing, safe mode-ing, and XP recovery console-ing was able to sort this one out. It was terminal.

So, as I sat back later that evening, on my comfy armchair, in my smoking jacket, swirling a snifter of port – I reflected. I think I had learned a little something at the end of the day. A little something about myself. A little something about responsibility. And a little something about not being so bloody cocky and complacent and assuming I know what I'm doing without reading instructions and without taking proper precautions before upgrading.

So there you go. It's all working now. In fact, it's fairly throbbing along compared to my P3, and I'm thoroughly happy with proceedings these days.

Although confidence is low that I'll remember all this the next time I perform an upgrade – which I'm sure will be another learning experience.

Until then. . .

Protect your PC from the Forces of Evil!

Fatal System Error

Lucky for you,
This game is in a secure partition.

Cool.

Enter to WIN a retail copy of PartitionMagic 8.0! Register today at www.groupservices.com.au/atomic and answer a simple question! (winners will be notified by email)
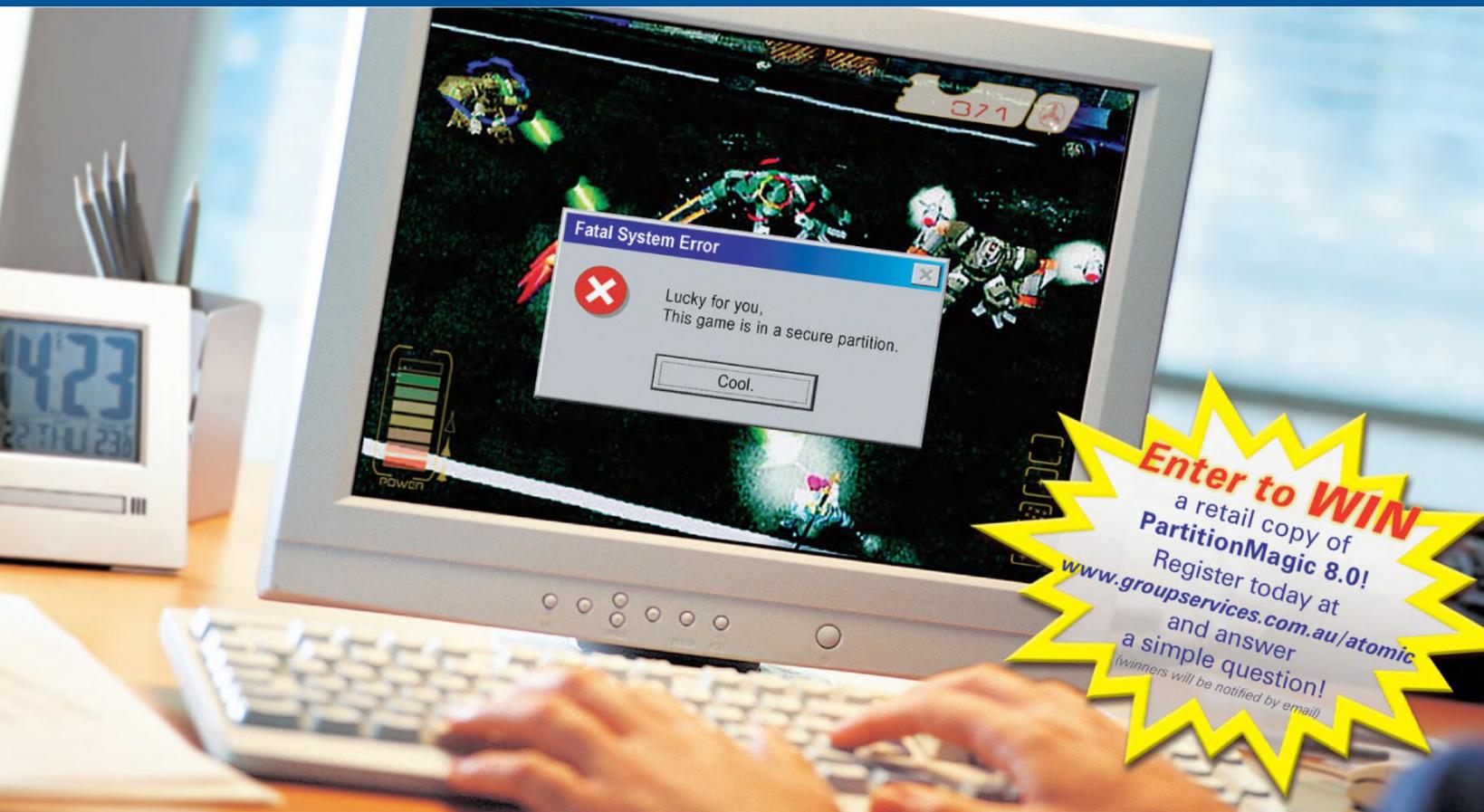
With New PartitionMagic 8.0

Hackers, system crashes, viruses, buggy demo games . . . it is a dangerous world out there for your PC. That's why you need to manage and protect your PC with PartitionMagic.

PartitionMagic 8.0 allows you to create, resize, move, and convert partitions without destroying your data. This allows you to safely run multiple operating systems, enhance operating system performance and protect your data. The benefits of using PartitionMagic include:

Worry-Free Downloading! Create a secure partition for downloading patches, updates, demos, and shareware. Keeping these files separate from your operating system will often prevent them from crashing your system or spreading viruses.

PartitionMagic 8.0
> Safely run multiple operating systems
> Separate and protect your data
> Enhance operating system performance
Create, format, resize, copy, move, convert split and merge partitions safely.

Faster Games! Creating separate partitions for your operating system, games, downloads and swap files can improve the performance of your PC.

Run Multiple Operating Systems! Do you have old games that only run on Windows 98? Simply partition your hard drive and load operating systems in their own partitions.

Protection from Hackers! Place your confidential, personal files in a hidden partition that hackers can't find.

The PowerQuest Atomic Offer!

The first 60 readers who purchase PartitionMagic 8.0 will receive a **16MB USB Flash memory stick**!

To order PartitionMagic 8,
call GSS on 1300 889 722
(within Australia only) or visit
www.groupservices.com.au/atomic/register.asp

GSS
GROUP SERVICES & SYSTEMS Pty Ltd

POWER QUEST

PFC decoded

Is active better than passive? Not if you're a submarine (ping!), and Dan Rutter believes it's the same with PSUs.

So you're shopping for a new PC power supply unit (PSU), and along with outrageous wattage ratings, multiple fans, funky cables, gold-plated connectors and little lights, some of them have 'Power Factor Correction' (PFC).

What the heck, I hear you all ask, is that all about?

A PC PSU doesn't have to have PFC, but practically all of them do these days. Most PSUs have passive PFC; fancier models have active PFC.

Active PFC, your friendly shiny-suited PC salesman may explain, is more efficient. He may also say that it'll save you money on your electricity bill.

This is not true.

PFC is, essentially, what you do to complex alternating current (AC) loads

> **...mere 'phase' isn't actually an adequate description for the differences...**

(like switch-mode PC power supplies) to make them act more like simple loads (like toasters).

Simple 'resistive' loads draw their maximum current at the points in the AC cycle when there's the maximum voltage across them. When the voltage reverses during each oscillation, so does the current. If you multiply the root-mean-square (RMS) voltage and the RMS current of a simple AC circuit like this, you get the power being drawn, in watts. Quite simple really.

Complex AC loads are not nearly this simple. Their current draw doesn't follow the voltage; it's out of sync. This is because the load is capacitive or inductive – 'reactive'. Reactive loads can even be both capacitive *and* inductive, in different mixtures over time.

The more complex a load is, the more out of sync the current will be with the voltage, and the worse the device's 'power factor' will be. The worse the power factor, the more *apparent* AC power you'll need to run it.

Multiplying a reactive load's RMS voltage and RMS current will give you the apparent power in volt-amps (VA, which you may remember seeing on the spec sheets for uninterruptible power

supplies), not the real power. Power equals VA times power factor.

Proper power meters, like the induction wheel meters that the electricity company uses to figure out how much you owe them, are meant to measure true power, not apparent power. The meters compensate for differences in phase between voltage and current. How well they do that is a topic for animated discussion among people who seldom have anything better to do on a Saturday night.

Particularly seeing as mere 'phase' isn't actually an adequate description for the differences between the non-sinusoidal waveforms that lousy power factors create. But the meters do more or less get it right.

So it doesn't matter much how bad the power factor of your various appliances are, at least as far as a domestic electricity bill goes.

The apparent power involves real current flow, though. A 1,000VA device with a power factor of 0.5 may only be drawing 500 watts, but it'll be causing as much current to flow through the wires as a real 1,000W device.

Electricity companies don't like this. The more current the mains grid has to handle, the thicker the wires have to be, the bigger the distribution transformers have to be, the more power will be wasted thanks to cable resistance, so on and so forth.

Industrial power customers are, for this reason, commonly billed according to their equipment's power *factor*, as well as its power *consumption*. The more of a mess they make of the mains, the more they pay.

(Well, that's the theory, anyway. The

formulae used to figure this stuff out can be baroquely complex. If you want mystifying equations, always look to accountancy before physics.)

And so, Power Factor Correction (PFC) is used. PFC sneakily makes reactive loads look more like resistive ones from the outside.

Passive Power Factor Correction is just compensatory capacitance or inductance across inductive or capacitive loads. It tries to iron out the oddities with passive components.

Active PFC is an actual second circuit. It sucks power from the mains in a resistive way and feeds it to the low-power-factor circuit on the other side, isolating the mains from whatever that circuit is doing. It can iron out lousy power factor better, but it's *less* efficient, not more. An active PFC circuit will waste some power as heat, just like every other circuit in the world.

This can still work out as a good deal for industrial customers, because improving the power factor of componentry reduces the amount of power generation and distribution infrastructure needed to support it, and also reduces their power-factor-linked electricity bill.

But if you're not being billed by power factor – if you're a home or small business, you're probably not – then an Active PFC PSU isn't going to consume any less real power than any other kind. It'll actually probably consume a little bit more, and that little bit more will be noticed by your electricity meter.

So by all means, buy an Active-PFC-equipped PSU if you like. They do no harm, and they're generally likely to be high quality units, less likely to do 'something horrible' to your PC. But don't think that PFC of any kind is going to save you any money if you're using ordinary domestic power.

The difference between car salesmen and computer salesman is that car salesmen know when they're lying, so someone who tells you Active PFC makes a PSU more efficient is not necessarily trying to pull the wool over your eyes. You'd still probably do well to buy from someone else though.

Barents Sea is a grave yard for many Russian submarines. During the Cold War, the Soviet Union (as it was known) rushed to match the technological expertise of American-made subs. While trying out liquid metal-cooled reactors and quench baffles, many subs had nuclear accidents and were dumped in the Barents Sea. To this day, they continue to leak contaminants.

ASUS V9950

Explosive Graphics Performance by

GeForce FX 5900 Series

- The world's most advanced, precise and powerful GPU - NVIDIA GeForce FX 5900 series
- All-new CineFX 2.0 engine delivers cinematic special effects
- The fastest DDR memory with 256-bit bus and AGP 8X interface
- ASUS proprietary online GameFace technology
- Industry's best platform for DirectX 9.0 & OpenGL 1.4
- nView multi-display technology for various display connectivity
- High valued software bundle: ASUS DVD XP S/W player and the hottest 3D games

ASUS *GameFace* Technology

Enables point-to-point video conferencing functions and online gaming to take place simultaneously

Models Available

- **V9950 Ultra/TD**
  GeForce FX5900 Ultra, 256M DDR
- **V9950/TD**
  GeForce FX5900, 128M DDR

OPEN GL 1.4 — OpenGL 1.4

Cine 2.0 FX — CineFX 2.0

D9X — DirectX 9.0

AGP 8X — AGP 8X

TV Out — TV-out

VGA VGA — Dual VGA

3 YEAR WARRANTY — 3 YEAR WARRANTY

HOTBOX

SHORT's Timber and Ice

I did the usual first, cut the viewing window and fan holes and got a light for the interior, then the search was on for an internal / external theme.

I toyed with the idea of computers and timber, which involved building a box around my PC, instead of the usual build a PC into a box. Having a bit of experience with match work art my ideas started to develop and fester. A bit odd, yes, but how cool would it be to have a box made of matches?

Then over a few ales with a mate I said, fairly seriously 'You know what I think would look cool, a computer covered in match sticks.' I took a sip of my beer and glanced at him. He shook his head in disbelief and looked at me like I was a weirdo.
'What, are you serious?'
'Well, yeah.'
500+ hours and 5,000+ match sticks later, 'Timber and Ice' was born.

Murray's MuzPC
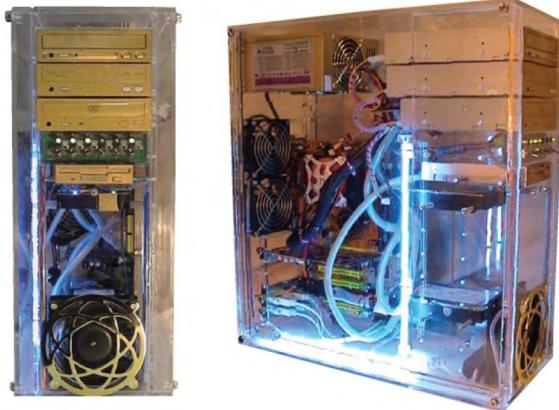
I love windows in cases, so I thought I'd go for the ultimate windowed case – a full Perspex PC. I used Visio to design and dimension it from scratch. A 6mm perspex sheet was cut to outside dimensions. Lesson one – get the edges polished at the retailer. Internal wiring from the Baybus, which controls fans and lighting, is contained within Perspex tubing. A 120mm Panaflow fan draws air in, the two 92mm and the 520W three-fan PSU draw it out. The design allows for hard drives to be mounted directly behind the 120mm fan. There is a 25mm gap behind the slide-out motherboard tray designed 'in' for a future enhancement. Initially everything inside was going to be blue, but the gold PS, front gold laser-cut fan grill and Soltek MB clinched it. I spray-painted the rear laser-cut and internal fan grills, the floppy and old CD drive. The newer CD-RW and DVD are covered with gold SolarFilm. The end result: a big, bright, crystal clear wind-tunnel, with a hell of a lot of grunt.

Justin's Precious

It all started when I saw this clear case. I like see-through things and needing to upgrade my computer. I had the perfect excuse to do so. I have never modded before, let alone built one, and now will do it for the rest of my life. It's so much fun! Without further ado I killed my bank account and purchased my hardware, then installed it all first so I could be playing Generals again ASAP. Then I started modding it. Sitting with my legs crossed for hours resulted in me taking a crash course (he he) on how to walk again when I tried to stand up.

Some things were hard to find. I really wanted a purple cold cathode and there were none in Australia. I found a seller in America and pleaded with him to send it to me. As you can see, I managed to get myself the cold cathode.

Hiding the wires was the most difficult thing. Got plenty of wire loom and tried to hide as much as I could.

Srdjan's Geronimo Box

My PC is exclusively used for graphic design and I plan on upgrading the graphics card. It's possible I will buy Matrix Parhelia rather than a RADEON 9700 PRO.

I first saw *Atomic* when it was at *issue 3*, coincidentally, this was when my old computer was just about to die. So I assembled a new one. I've changed the look a few times, mixing different colors and changing the components – nothing's final.

All the fans are silver, as are the tubes for the leads. From the ideas I've borrowed from others, the dearest one to me is the power supply mod. I'm very satisfied with the look of the inner case walls. I haven't seen any similar solutions that are so effective yet. I used PVC foil, which gives fantastic translucent effects. Don't tell me it all looks too old-fashioned. grew up reading *Flash Gordon* and I'm 58.
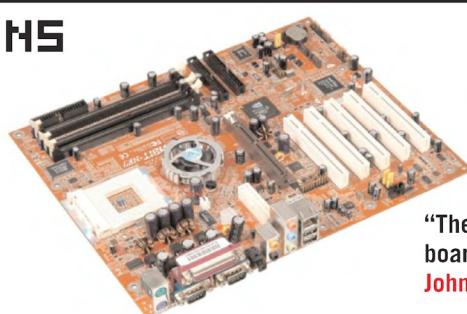
1 CLEARLIGHT 30GB FIREWIRE HARD DRIVE

SUPPLIER: Silicon Memory Technologies
WEBSITE: www.siliconmemory.com.au
PHONE: (02) 9417 7822 **PRICE:** $405

A FireWire hard disk with a slick sexy feel; it's just the thing to get your drive motor running. Encased within a sturdy transparent shell, this chick magnet holds 30GB and spins at a spinny 4,200rpm. Reasonably fast considering it consistently copied a 100MB compressed file from an internal drive in five seconds. As small as it is, you can easily cart it around in your pocket. . . or someone else's. This wet dream inducer even has a trippy bright-blue LED. Spoogalicious! Now have a cry at the price.

2 PSU CABLE SLEEVING

SUPPLIER: Kore Computers
WEBSITE: www.korecomputers.com
PHONE: (02) 4968 1448 **PRICE:** $45

Not only do sleeved cables provide your case with better airflowability, they also prevent your beast from appearing as the ultimate clunky chunk of twisted schmuck. However a good amount of finger-fiddling is required to install the pesky things. This is where Kore Computers comes in; you choose the colours and it does all the fiddlies for you. A better job could not have been done on the Thermaltake PSU we looked at; it's modded with blue sleeves and looks professionally slick. It's a little rich but it looks great and you don't need to worry about wire-hungry scissors.

3 THERMALTAKE HARDCANO 10

SUPPLIER: Anyware
WEBSITE: www.anyware.com.au
PHONE: (03) 9763 8200 **PRICE:** $70

Do you like control? Well you can dictate when your neighbours sleep with the inbuilt adjustable heat alarm the Hardcano 10 provides. This rather professional-looking front bay controller comes fitted with one FireWire and two USB 2.0 pass-through ports, a temperature monitor, two fan speed controllers and an LCD display. Although full of goodies, it isn't equipped with a flashy backlight for the LCD display. All in all this is a nifty treat for your domineering desires.

4 MASTERS OF DOOM

SUPPLIER: Random House USA
WEBSITE: www.randomhouse.com
PHONE: N/A – available for online purchase only
PRICE: $US24.95

id Software is perhaps the most god-like games developer of the 90s. Single-handedly creating the first person shooter genre, it permeated the very early days of PC gaming, from Commander Keen through to Doom and Quake. *Masters of Doom* is a look at the history of id, right through Romero's split to form Ion Storm and the rarely mentioned skirmish over whether or not it would do Doom 3.

An entertaining read, author David Kushner focuses upon a very narrow slice of the US gaming industry and the book lacks real context in the wider gaming world. It centres mainly upon the divergent personalities of the twitch gaming obsessed John Romero and the introspective tech wizardry and vision of coder/god John Carmack. A very factual retelling of the story of id – definitely more entertaining than replaying Daikatana.

GEARBOX

5 A4 TECH USB BATTERY RECHARGER

SUPPLIER: Anyware
WEBSITE: www.anyware.com.au
PHONE: (03) 9763 8200
PRICE: TBA

Whoever decided to pump power through a USB port is a genius. While the supply isn't enough to run external optical drives, its uses are still being explored.

The A4 Tech USB battery charger is a great example of this innovation. It can charge two AAA or two AA batteries at a time, which caters perfectly to the power requirements of PC attached items like the many wireless peripherals now available.
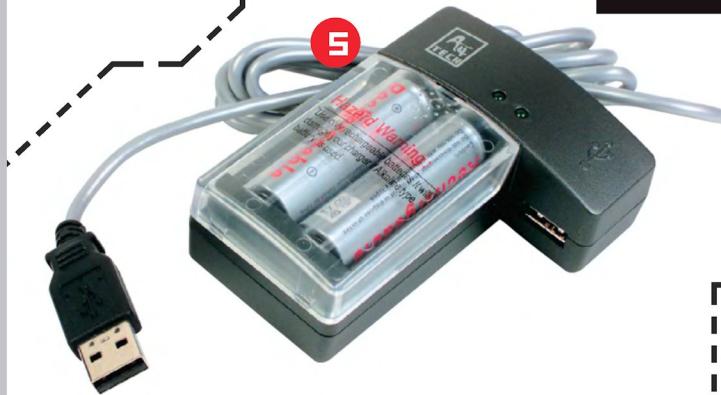
6 GAME BOY PLAYER

SUPPLIER: Nintendo
WEBSITE: www.nintendo.com.au
PHONE: (03) 9730 9822
PRICE: $99 stand alone; $329 bundled with GameCube

Taking a game designed for the small screen and stretching it to a TV can be a dangerous move, something that was all too obvious with Nokia's recent N-Gage launch at E3. A game that looks stunning on a Game Boy Advance could very well look crappy on your television, but with such a huge range of quality titles for the GBA it is unsurprising that Nintendo has created the Game Boy player.

It sits on the base of the 'Cube and provides a cartridge slot for you to run GBA games on your TV. You can either use normal 'Cube controllers or a GBA as a control pad. As long as you realise the limitations of the small screen format it blows wide open the range of games available for the 'Cube.

The good news is that the player is bundled with all new GameCubes sold from June 20 at the now regulation console price of $329.
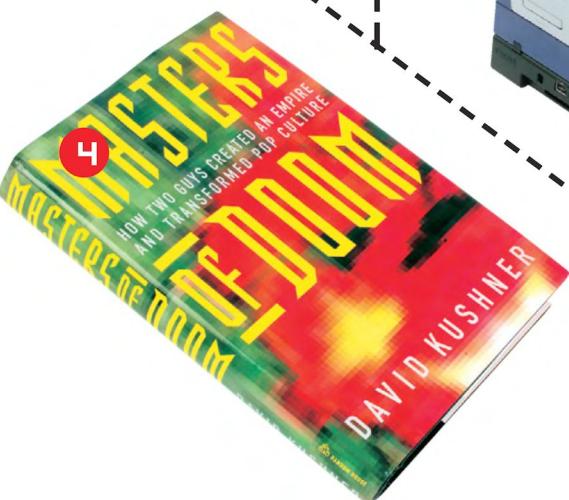
7 IOSS RD3XP- CD5 SUPER SHIELDED AUDIO CABLE

SUPPLIER: IOSS
WEBSITE: www.ioss.com.tw
PHONE: PC Range (08) 8322 9544
PRICE: $25.00

Is your CD sound being distorted by a dodgy audio lead? Quality interconnects are critical for high-fidelity performance of any audio system, but who sells Hi-Fi internal audio leads for computers?

To compliment their brilliant range of rounded IDE cables, IOSS have just released the high-tech RD3XP-CD5 audio cable, featuring ferrite / EMI cores with full length metal-mesh shielding, cleverly designed to minimise high-frequency interference and improve audio quality.

Available in 50 / 80cm lengths, this cable will make a positive aural difference that you can see.

Volcanoes, on Earth at least, mark the borders of its tectonic plates. Venus, which is like Earth (if you can excuse the sulfuric atmosphere and the 400-odd degree surface temperature) oddly enough has no evidence of tectonic movement. However it does have a bunch of volcanoes. Cue *Twilight Zone* music.
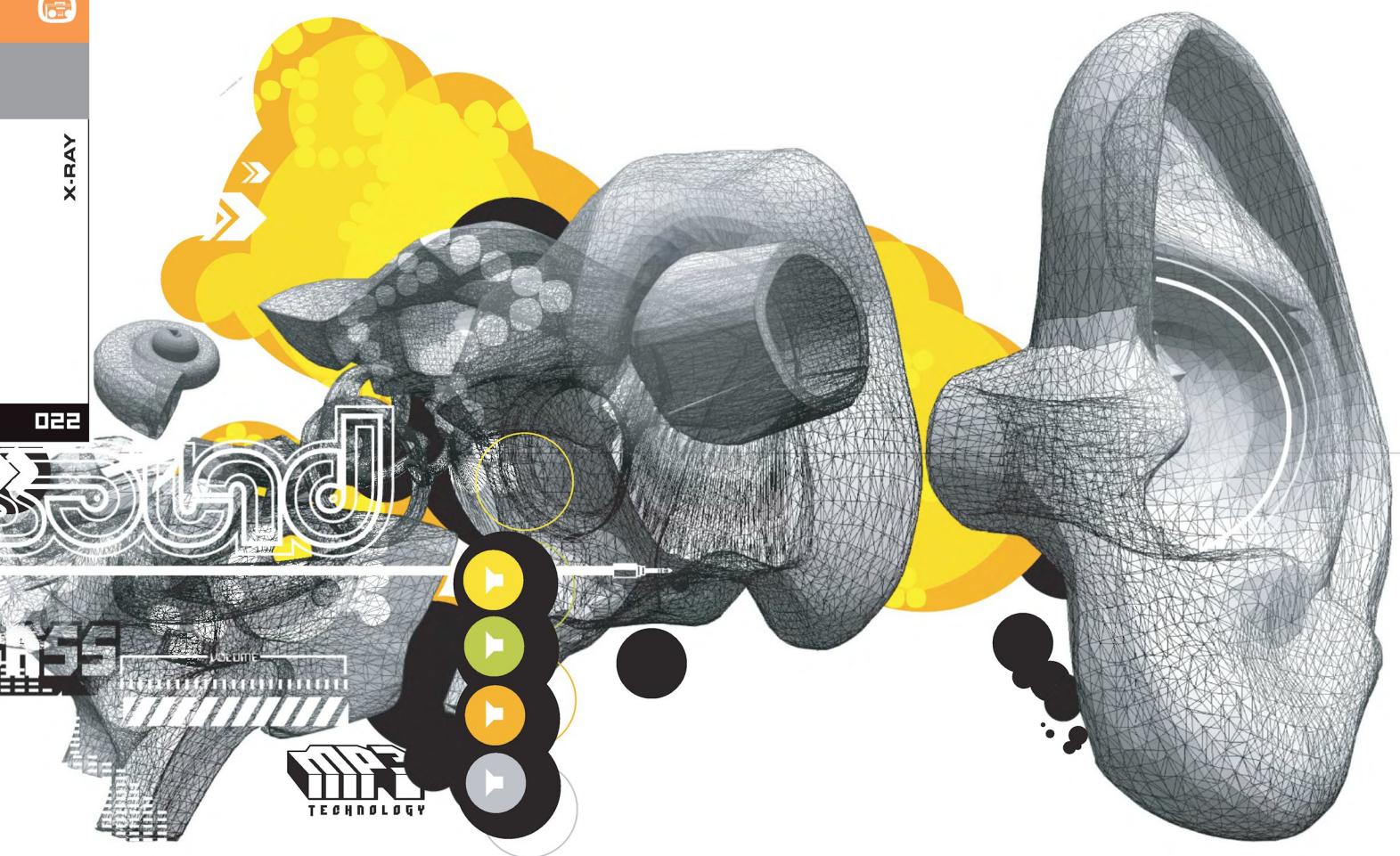
Sound wares

DirectX. . . you do know it's more than just Direct3D? Audio plays as big a part in nurturing virtual reality as graphics, a sentiment that sounds exactly right to Logan Booker. He's been off investigating DirectSound, EAX, A3D and WDM.

Don't blame yourself – it's hard to suppress the smile that creeps to the mouth in this age of six-month product cycles and recycled genres; a sly smirk when you realise there's still a subconscious prioritising of crucial elements in the games industry. Graphics first, sound second. So, while programmers worry about optimising 96-bit colour paths and making sure the AI doesn't leap off cliffs to ambush shipping crates, a small group of engineers, versed in the ways of DirectSound and various doomed positional audio APIs, skulk beside the 3D engine and throw in the odd trigger and sound routine.

And a few moments before the product is sent out the door, someone idly play-testing the final debug realises the .38 Special sounds like a buzzard sucking down Vaseline. Mad fumble over upturned chairs and empty soda cans, and the publisher is beating the living snafu out of the audio programmer. Okay, maybe not the *living* snafu – but it is about time we had a careful look at game audio. With the major focus these days on detailed models, pretty pixel effects and realistic physics, it's probably the one area in games development always dumped by the roadside and left to find its own way home on the highway of implementation. It's a sad story indeed.

◼ WAVELETS IN THE OCEAN

'Typically, audio coding gets left to the last minute and is often done by someone other than a dedicated audio programmer,' says Peter Clare, Technical Director at Sensaura in the UK. It's hard not to agree; we've all seen games with sub-standard sound. Battlefield: 1942 blossoms instantly in mind, and it's only now, after four or so patches, that the engine can handle EAX and more than 16 voices. This is still easily debatable though.

Why the sudden rush to get things done towards the end of development? '[It] reflects the (historical) lack of importance given to game audio. Happily things are changing and developers and their publishers are waking up to the benefits that good game audio can bring.' Peter says.

Audio engine development tends to run parallel to the actual game, as more developers realise the importance of a good audio engine. Like hazy flames or shimmering water effects, sound and music have the potential to heighten a scene beyond its simple three dimensions, rather than just complement it.

According to Creative's Liam Byrne, Developer Relations Manager for Gaming Applications, and Daniel Peacock and

Carlo Vogelsang, Creative software engineers, 'The toughest part is to make sure a sound engine works everywhere . . . [a] low level sound engine [is used] . . . [it] talks directly to the APIs (DirectSound, OpenAL etc) and just abstracts away the low level API, so that it's easy to swap with whatever is decided for later on in the development cycle.' What this means is that a very basic audio engine is created early so programmers don't have to worry about the engine rejecting audio calls. Also worth a mention is OpenAL, an open source and cross-platform alternative to DirectSound that has similar functionality. Even though the company developing it, Loki Games, shut down a while back, it still lives on.

Way back in the day of Windows 95, budding developers and gamers alike got their first taste of DirectX. While it's doubtful people lined up at stores to purchase the OS specifically for its multimedia libraries, DirectX was none the less tantilising. No more programming archaic functions for Sound Blasters and Gravis Ultrasounds, or trying to decide on a third-party audio solution (such as Miles Sound System, seen in titles such as GTA3 and Warcraft 3; or LucasArts' iMUSE, used in all of the company's SCUMM-based games). True, the ISA bus would continue to plague developers for a few years until the mass uptake of PCI sound cards and the banishment of onboard memory to store samples, but things were looking sparkly.

DirectX 3.0 was the first notable version of Microsoft's 'solution' and to be fair, DirectX is a solid idea. It consists of two interesting components: the Hardware Abstraction Layer (HAL), and the Hardware Emulation Layer (HEL).

The HAL stands between DirectX, your OS, and your hardware. When your system wants to manifest itself in multimedia form, and such a form could be generated in hardware, the HAL queries your system using the 'GetCaps' function in code. GetCaps has been known to lie from time to time, so some developers use a trial and error approach to determine the supported modes of hardware. This means gradually upping capabilities until the hardware crashes. On a side note, Windows NT, 2000 and XP all use HAL for standard hardware calls, and it's a significant part of the OS and hardware relationship.

If HAL returns a negative on the functionality, the HEL kicks in to emulate. In our case, DirectSound would step in to do 3D audio – and like any sort of software rendering, it's a poor substitute for hardware.

Along with this new way of doing things, DX 3.0 introduced 3D sound buffers, allowing developers to use basic positional audio without hardware support. However, DirectSound was very much an infant. The positional audio implementation in 3.0 was poor, fraught with problems including distortion and speed. On a 100MHz Pentium (a beefy system back then), the 3D buffers would consume 5.5% of the CPUs cycles. Per channel. That's *a lot* of resources to burn for a single channel. Even today, DirectSound is inferior to hardware sound. It was nothing more than a novelty (and some may argue that it still is), and developers would likely been happier with an algorithm using basic stereo pan and roll-off.

■ MIDI GROUND

Microsoft must have been hard at work, because when it came back with DirectX 5.0, things had improved considerably – 3D sound buffers could now be accelerated in hardware. Hoorah.

On show were DirectSound and DirectMusic, both multimedia-heavy subsystems dedicated to producing audio. While DirectMusic was a full-featured and provided greater control, DirectSound was a light-weight and flexible sound API – perfect for games, where CPU time was better spent rendering frames
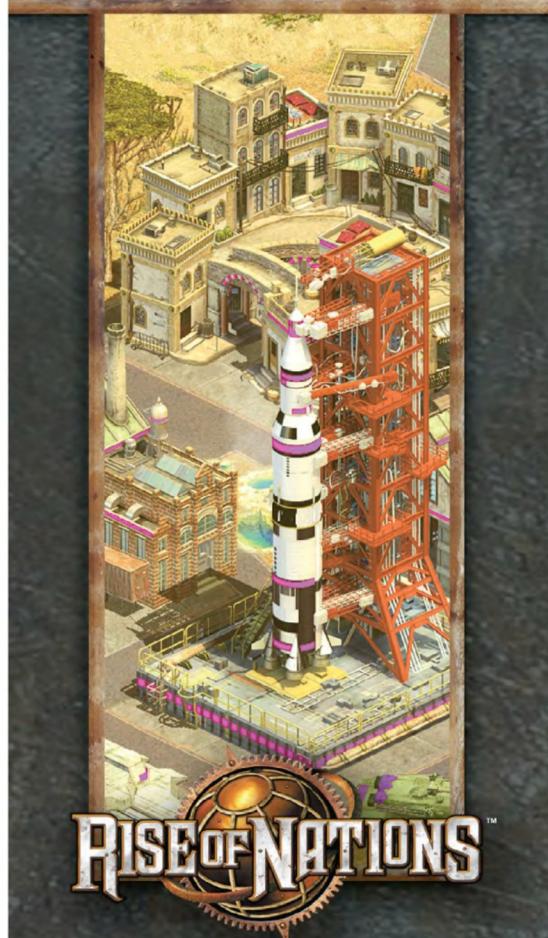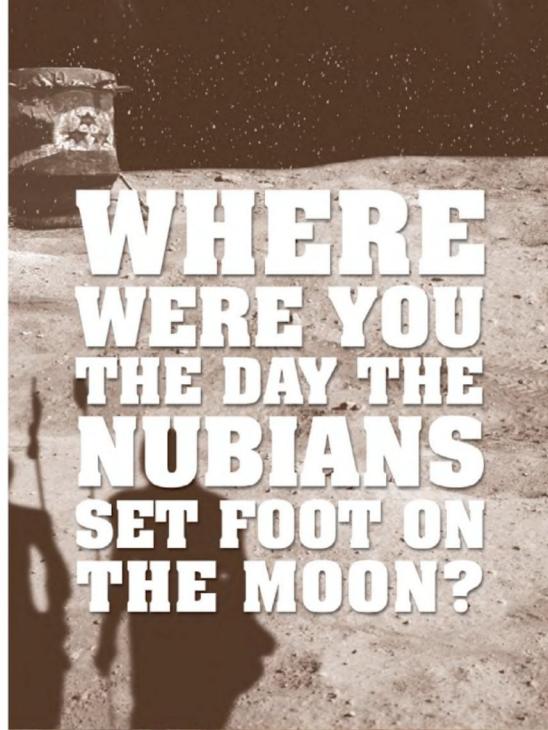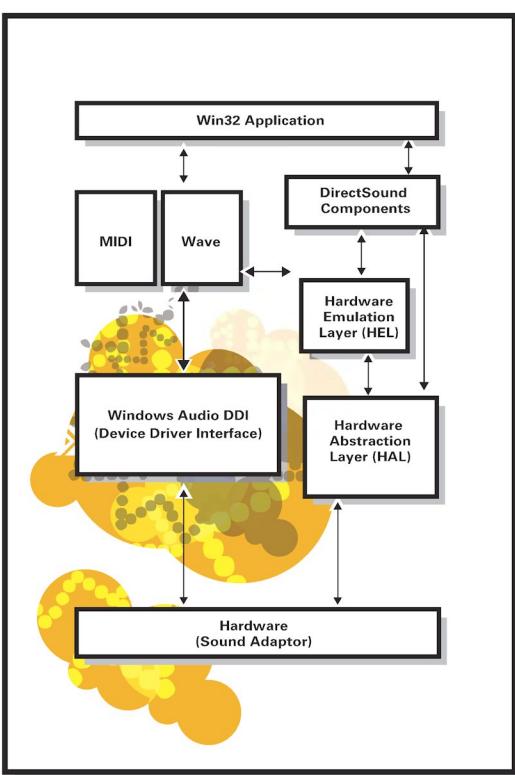
Win32 Application

MIDI | Wave | DirectSound Components

Hardware Emulation Layer (HEL)

Windows Audio DDI (Device Driver Interface) | Hardware Abstraction Layer (HAL)

Hardware (Sound Adaptor)

WDM Audio Architecture for Windows XP

WinMM Application → WinMM.DLL → WDMAud.DRV
DirectSound Application → DSound.DLL

User Moder / Kernel Mode

WDMAud.SYS → SysAudio.SYS

SWMIDI.SYS — Kmixer.SYS — Redbook.SYS
GM.DLS

Port Class Driver (PortCls.SYS): Wave-Cyclic Port, WavePci Port, MIDI Port, DMusic Port, Topology Port

AVStream Class Driver (KS.SYS): USBAudio.SYS, AVCAudio.SYS

Winders Components / Supplied By Vendor

Adapter Driver: Wave-Cyclic Miniport, WavePci Miniport, MIDI Miniport, DMusic Miniport, Topology Miniport

ISA or PCI Audio Card

USB Audio Device

IEE 1394 Audio Device

---

than decoding WAVs or synthesising MIDIs. With this new DirectSound came a property set called 'Voice Manager' that allowed the creation of sound buffers without the need for hardware or software resources to be assigned to them until they were played. This meant sound buffers could be created without the fear of using up system resources as the OS would automatically distribute grunt as needed: when the sound card queried the system to play the sound, all it needed to do was point the card to the memory address. Voice Manager made playing audio much more efficient over a PCI bus. On the slower ISA bus it wasn't something you'd do if you wanted sounds to play when they were called in code – the latency was too prohibitive. DMA transfers over an ISA bus were also resource consuming – 30% total cycles for a Pentium 90MHz. Ouch.

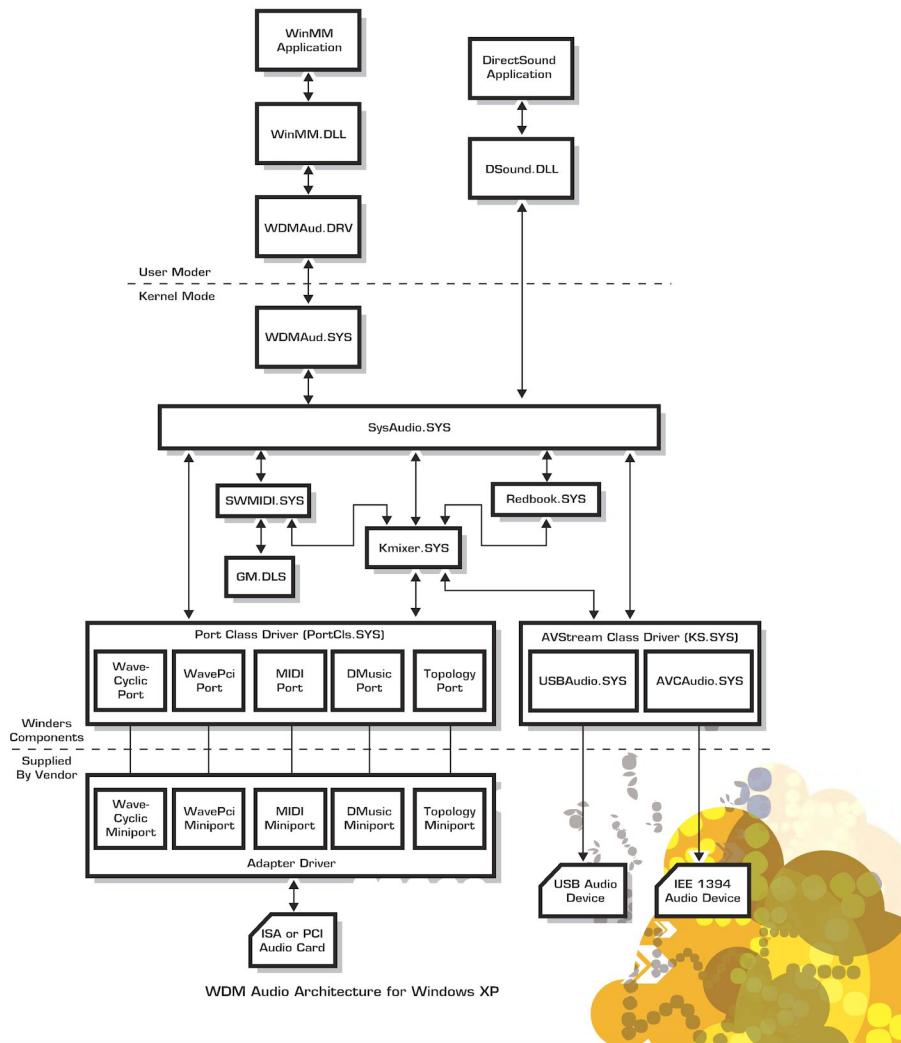By this point in DirectX's history, VxD sound drivers had maturedl, however the burden remained on sound card manufacturers to code them – WDM (Windows Driver Management) was on its way to solve this.

CRASH! BANG! CRASH!

With the release of Windows 98SE, the audio situation degraded once again. Voice Manager was broken with DirectX 6.0, causing problems with games that used the feature. So what happened?

DirectSound had been recoded to intercept Voice Manager calls instead of leaving them to the sound driver. Microsoft realised that this would never work out in the long

run (as drivers developed new features) and abandoned the idea. In doing so, it left in some code preventing Voice Manager calls going to the sound card. The end result: games using Voice Manager would have samples that either played incorrectly, out-of-sequence or not at all. Sensaura discovered this problem and informed Microsoft. Suffice to say, it was fixed in the next release.

DirectX 7.0 and 7.0a were the last major releases for DirectSound. The focus now for DirectX is graphics, and as such changes between 7.0 and 9.0 have been minor. 7.0 did introduce tweaks and improvements to the software capabilities of DirectSound, with an improved stereo pan algorithm and a repaired Voice Manager. It was now (mostly) obsolete however, as new flags had been added to duplicate Voice Manager's functionality, and Microsoft advised developers to stop using it.

For a time, Microsoft pushed DirectMusic and not DirectSound for doing game audio. As explained earlier, DirectMusic is more feature-rich; however, it relies on DirectSound to manipulate audio buffers and to produce 3D sound. Even though music in games has moved away from MIDIs and towards MP3s (and other formats), DirectMusic was, and still is, a complex collection of API functions that simply get in the way. Microsoft seems to have clued-up in this regard, and it no longer pushes DirectMusic as hard. Monolith has done some impressive stuff with it though (music fades in No One Lives Forever 2), so maybe not all is lost for the subsystem.

ALL GROWN UP

WDM, Microsoft's multi-platform driver solution replaced VxD, the legacy driver format from Win95. Its main effect, funnily enough, was reduced performance caused by the cumbersome communication between the driver, DirectSound and the OS. Creative's engineers agree: 'It didn't necessarily affect game level development that much from an API standpoint . . . but it did have a significant impact on performance of hardware-accelerated platforms. It put more stress on "clean-coding" (not making redundant calls, not making too many calls etc).'

While the type of driver is for the most part transparent to the operating system, Voice Manager doesn't work with WDM (the same goes for Sound Blaster emulation – it was only provided for in WDM for 98/ME. It isn't supported in 2000 or above).

There are a few advantages to using WDM drivers as opposed to VxD. First off, WDMs are multi-platform. Except for Windows 95 and earlier OSes, they are compatible over

the entire Windows range, and identical source code works fine across platforms. WDM also handles all low level operations required to run the hardware they are programmed for, including allocating DMA adaptor objects (for direct memory operations) and flushing I/O buffers. WDM also introduced 'kernel streaming' filters. These filters provided data streaming for time-sensitive operations – perfect for generating and managing sound reproduction. By negotiating different filters, data can be encoded, decoded, compressed and encrypted depending on the filter used.

DirectSound using VxD was also limited in terms of what sound could be mixed – only audio produced by DirectSound was malleable. With WDM, DirectSound, WaveOut (the standard API for sound output in Windows) and other sources can be mixed to produce audio, and both DirectSound and WaveOut can work at the same time (whereas in VxD they could not).

In regards to functionality, WDM sound drivers provided a host of capabilities to the audio programmer. Funny thing was, these same functions were also available to VxD, however they were 'locked out' for developers who only had the choice of traditional stereo pan. Why this was done is unclear, but it was most likely a move by Microsoft to get developers using WDM.

It was designed to take some of the burdens of driver creation off vendors, while also distancing them from the hardware to promote a 'cleaner' environment.
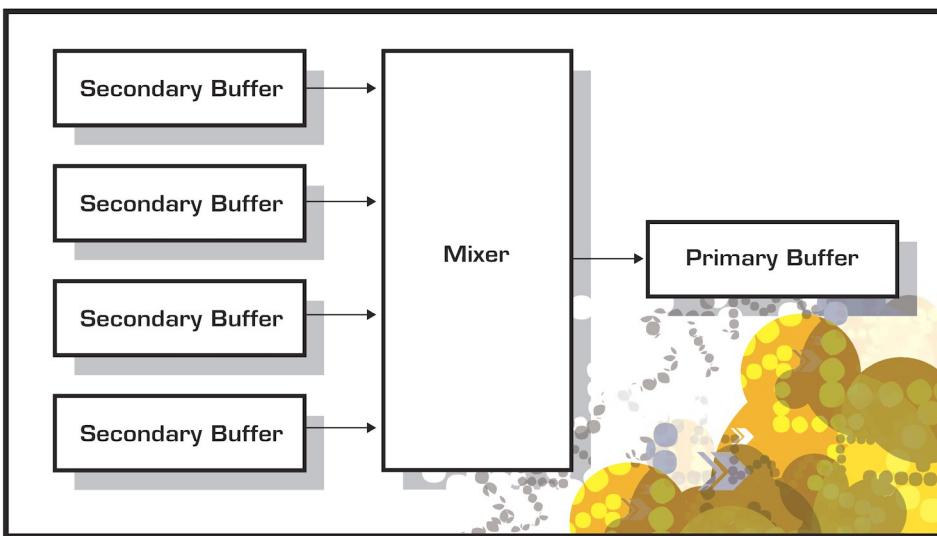
■ BUFFER ME

No matter the API or driver architecture, the starting point for generating any audio effect is creation of a sound buffer, which is basically done as follows:

■ The sound buffer itself is created to store an audio sample,
■ Hardware and memory resources are allocated to the sound buffer,
■ The buffer is locked so the reading of the effect can start, and to prevent other applications from overwriting the space,
■ Sound data is read from the hard drive or memory and copied into the buffer,
■ The buffer is then unlocked – an important step for static buffers over an ISA bus. It's also a nice thing to do for the operating system, as no other application will be able to access that buffer until the game is exited,
■ Finally, the sample is played, meaning it is copied, fed to the appropriate codec (MP3, ADPCM or plain PCM for instance), and turned into audio.

For games, a major part of audio engine design is the order and sequence that buffers are created, read to, read from and released. Proprietary engines can be a mixed bag however, according to Peter Clare: 'The main problem is that developers usually take the easier route of "lowest common denominator". Since 3D audio isn't present as standard in most APIs other than DirectSound the easy option is to just omit doing any 3D audio positioning.' When they do have it together, most developers employ one (or a hybrid) of the following:

■ Use Voice Manager or equivalent functions – simply termed 'voice management' in later DirectX versions – to preload all the required sound effects and music;
■ Create and destroy buffers on the fly as they are required by the game; or
■ Use a small number of streaming buffers, which are constantly fed sound data.
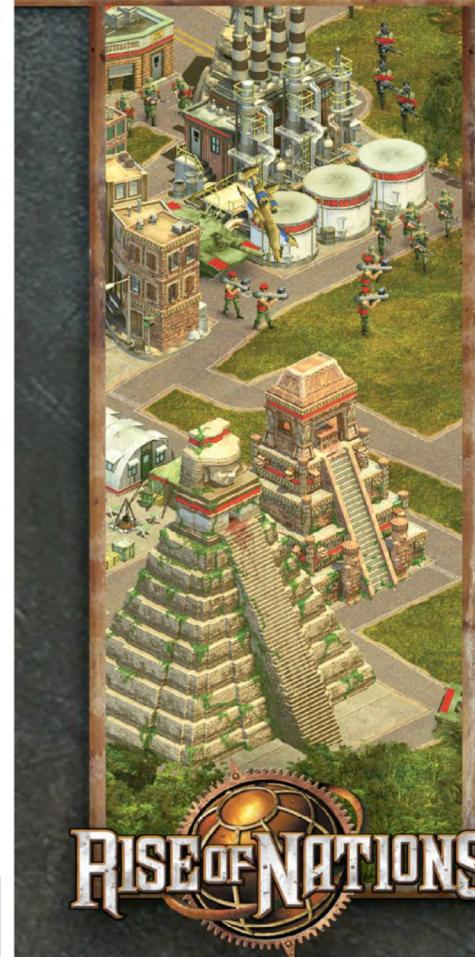
Secondary Buffer → Mixer → Primary Buffer
Secondary Buffer
Secondary Buffer
Secondary Buffer

Before delving into these techniques, it's good to know the difference between secondary buffers (static and streaming) and primary buffers (output from the mixer).

Secondary buffers include static and streaming. A static buffer is filled once and simply played. It's a self-contained buffer good for one-off, short sound effects, such as a gun firing. A streaming buffer on the other hand is continually feed and is never 'completely' empty. This allows large sound effects (including music) to take up only a small amount of resources – they are simply read in manageable chunks and played. Streaming buffers are also good for playing 'partial' sounds, such as a fades between two sounds.
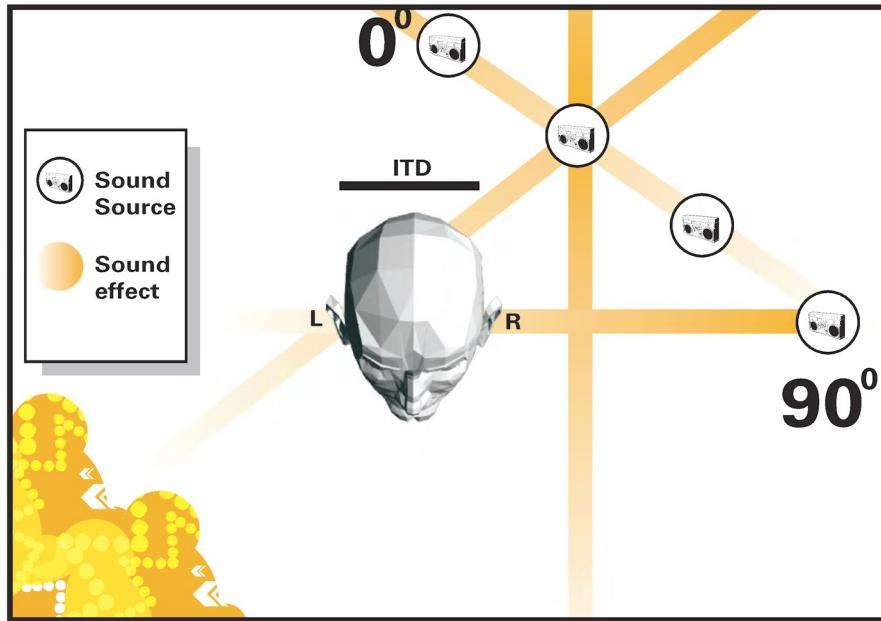
ABOVE: An example of Interaural Time Delay (ITD, next page). Imagine a sound coming from the player's right (90 degrees). The sound would, of course, reach the right ear first, and about 580 micro-seconds later, the left ear.

A primary buffer is filled via a mixer, which in turn is supplemented by a set of secondary buffers. These buffers 'fill' the mixer with sound, which is then combined and fed into a primary buffer where it can played. Like a mad scientist brewing a fiery concoction, so too can a primary buffer be full of volatile audio, ready for soaking up by ear and drum. It's a little more complex than just dumping audio into the mixer – in fact, it's considerably more complex – but the important thing to remember is that the mixer performs all the necessary actions to form the audio (distortion and the like).

As for the different methods – the first, involving voice management, carries the penalty of the longest load times and initialisation, with the benefit of keeping the overhead of readying the audio during play out of the game's way.

Dynamic buffer creation via the second method is the most resource-friendly, however, it incurs latency as samples are read and played.

The final method that makes use of small streaming buffers may seem like a compromise between the first and

second techniques; however, it isn't suitable for all applications. It puts the greatest strain on the game's audio engine, as it has to duplicate the capabilities of DirectSound.

JAMMIN LAYER

As far as 3D audio is concerned, DirectSound is just a basic positional API. When you want the spiffy effects and 3D sound you need an additional layer. This is where technologies such as EAX, A3D, QSound and 3DPA (Sensaura) step in. Of the technologies, A3D (version 1.0 especially, before Aureal caught on to the idea of reverb) is the most resource-hungry, as it uses wave-tracing as opposed to reverb. While this method does track the paths of every sound effect and provides a better representation, it's very hardware intensive.

According to Creative, 'The major benefit of wave-tracing would be that it works "automatically" once the geometry is fed to the wave-tracing engine, the down side is that it can only analyse large polygons (due to CPU load limitations) and it will only generate the early discrete reflection part of the reverb.'

On the other front, there's reverb. This technique is employed by EAX, 3DPA and QSound. Although EAX acquired A3D back in September 2000, the company has yet

BELOW: An example of Interaural Amplitude Difference (IAD). From point 1, a sound would need only pass your cheeks to get to your left ear. From point 2, it would need to travel through your skull, significantly changing the sound's properties.
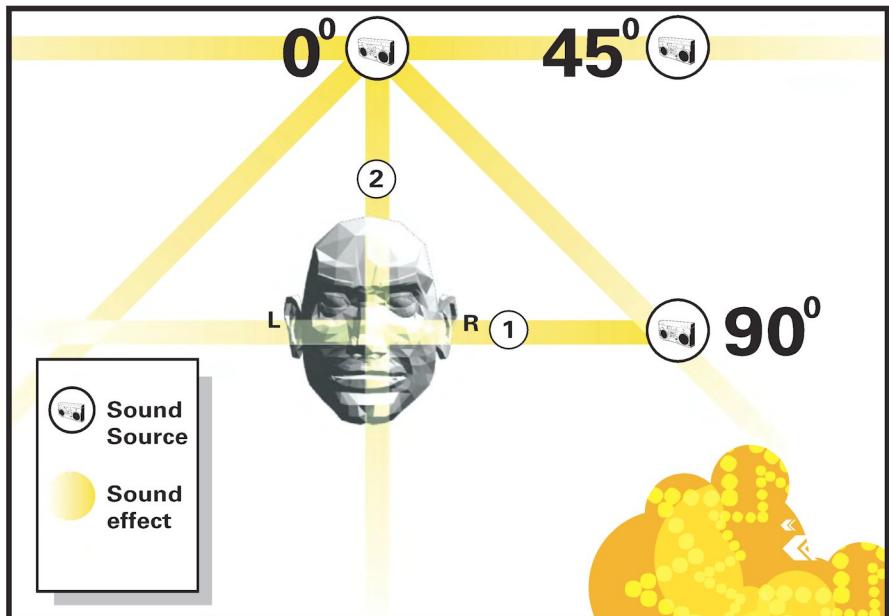
to use any of its wave-tracing technology.

Reverb is sufficient for today's needs and is less demanding, as it uses a number of presets (selected by the programmer when coding) to produce positional sound. This also happens to be its biggest weakness. 'EAX's statistical reverb model . . . need[s] to be designed for, and assigned to each individual area; it requires work from the level designer and/or sound developer. The major upside is that
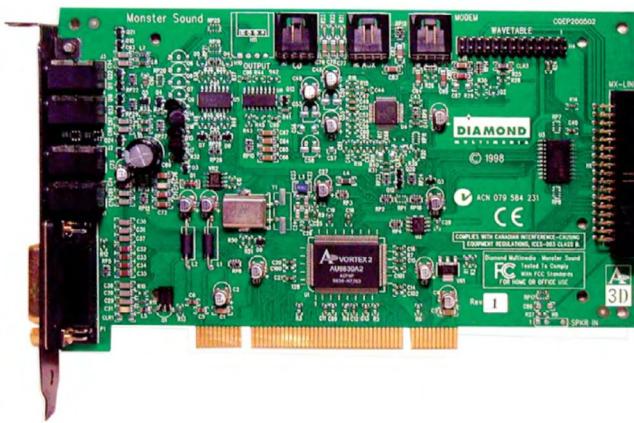
ABOVE: A Diamond MX300, which used Aureal's Vortex 2 sound chip. It was one of the last chip models ever released by the company.

this reverb is running completely in hardware and takes very little, if no, CPU time to compute.'

A common mistake is to confuse the rendering technology (EAX, for example) with the underlying API (DirectSound). It's not a case of 'one or the other' when 3D audio is generated – they are separate entities that work together. DirectSound provides co-ordinates to position the sound, while the rendering technology applies algorithms to make it '3D'. However, Peter points out that 'slightly confusing the situation is that both EAX and A3D are/were used by Creative and Aureal to refer to their underlying rendering technologies in addition to being the names of APIs.' It's easiest to imagine EAX and A3D as a layer of jam spread over the top of DirectSound – they're there to enhance, not replace the flavour (EAX is also compatible with OpenAL, so developers aren't forced to use DirectSound).

Today these algorithms are based on HRTF (Head Related Transform Function). HRTF involves the use of a dummy head and sensors to detect changes in frequency and volume as sounds are received from different locations. HRTF is complex, and rendering engines use a variety of measurements of ear sizes and shapes to give a good representation of how we 'hear'.

The two main factors in HRTF are the Interaural Time Delay (ITD) and Interaural Amplitude Difference (IAD). The ITD is the delay between a sound reaching one ear and then the other. The IAD is the change caused by your

head (and other objects), as the sound travels through it to the ear. While these are sufficient for calculating sound at a large number of angles, they can't differentiate between sound from in front or behind a user (as the values would be identical). Thanks to the shape of the pinna – the visible part of the ear – we can easily tell this difference via the way a sound bounces on the pinna's many surfaces. In rendering engines this has to be emulated.

Currently, EAX only allows the use of one reverb effect at a time. Creative is working on EAX 4.0, which will let developers use three reverbs at once. Creative is doing this to address the fact that '. . . reverberation is not statistically correct at all times, [as it] can not dynamically change like reverberation does in real life.' By having three reverbs, 3D sounds can be modelled more realistically depending on the environment.

■ END NOTE

All these technologies combine to produce the audio we hear in games today. Imagine if development in sound was as frantic as 3D graphics. . . yeah, 'wow'.

It all seems so simple and powerful now, but audio programmers learned (and endured) much over the years with DirectSound. Appreciate the immersion – it'll be a while before we have advanced wave-tracing algorithms. So enjoy reverb.   ○

BIBLIOGRAPHY

Massive thanks to Peter Clare, Technical Director at Sensaura, Liam Byrne, Developer Relations Manager for Gaming Applications at Creative, and Daniel Peacock and Carlo Vogelsang, software engineers at Creative, for their help answering questions regarding DirectSound, EAX and A3D.

HRTF 3D Positional Audio Overview
www.cmedia.com.tw/pdf/e_c3d_tech.pdf

DirectSound trips and traps
www.sensaura.com/whitepapers/pdfs/
devpc014.pdf

Microsoft Developer's Network (MSDN)
http://msdn.microsoft.com

Gamasutra
www.gamasutra.com
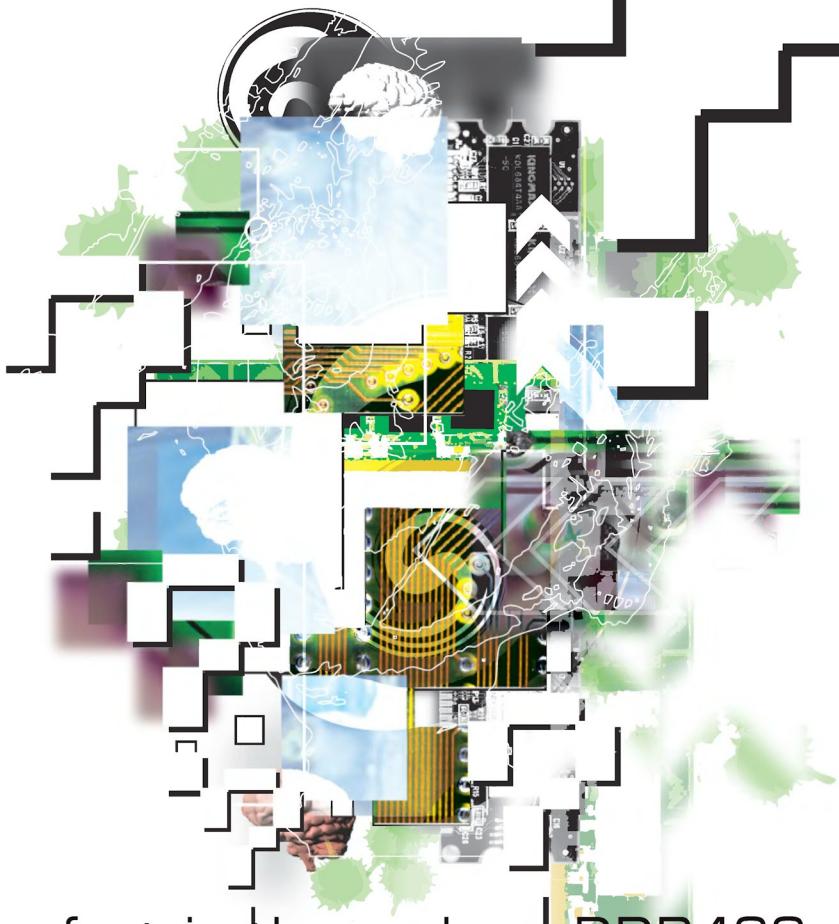
Slugfest in the ranks — DDR400 dual-channelism

Watch the wild action that ensues as Nathan Davis throws DDR400 into the dual-channeled sweat chamber.

As we know, when DDR RAM first popped into this cutthroat industry, the effectual speed boost of the new memory was practically zip; with all those wonderfully enthusiastic marketing papers just as eagerly thrown to the hungry BFS (Big Fat Shredder). When the dollar factor was added, it simply wasn't worth purchasing and merely made SD RAM look all the more tasty. Not exactly the ideal way to break into the market.

Of course, the tables have been spectacularly turned and those now decomposing lumps of marketing paper are turning in their soggy graves. With memory frequency constantly increasing combined with a double pumped data rate, performance boosts have arrived in giant leaps and bounds for that whoop-arse boom stick we now know and love.

As if higher frequencies and faster transfer rates in DDR memory weren't already enough to satisfy our unhealthy obsession for all things speedy, dual-channel came along and blew us right out of the water.

This is what we refer to as SD RAM living off a double dosage of steroids. So how does DDR400 perform once unleashed onto the dual-channel playing field? Hold on to your seat, let's explore the entrails.

Don't worry, it's not as gross as it sounds, there's plenty of electronic bits and pieces to keep it real. Real computer-like, that is.

■ DDR DO SOMETHING

After its somewhat underwhelming flop-onto-the-market stunt, DDR underwent some impressive improvements. It's now light years ahead of SD in terms of speed; but as irony would have it, it uses the exact same architecture – there are just a few minor improvements that have a slightly massive impact. So SD isn't *really* dead, as it had room to be improved upon. This was of great benefit to everyone, as the manufactures didn't have to do anything drastically different to the fabrication process, which means it remains affordable for us.

The major area of improvement was in the clock. All memory requires a clock, as do practically all internal computer components. Without one there would be no control of data flow, and we'd have lost bits flying all over the place, with major collisions wreaking absolute havoc. Because of this, there is a main system clock by which various components are synchronised and this comes in the form of the FSB.

Firstly the clock measures time in what is commonly referred to as a cycle (the 'tick' of time). This cycle is then returned, and converted to an operational frequency which the computer can use (in this case, the FSB) and then the end result is used in the actual component.

A top example would be on a processor. The only way the CPU can use this frequency to its advantage is by using a

multiplier, which multiplies the FSB by an incremental number. Multiplying, or even dividing the clock (PCI for example uses approximately 1/4 of the FSB speed) still keeps the overall 'beat', but with more or less 'sub-beats' in-between. Please, at least pretend to nod your head.

Practically every component is enslaved by this main system clock, with data only allowed to be sent and received each time the clock cycles. It does this in a sine wave-like fashion, with both a rising and a falling edge of the clock.

For each cycle, SD memory uses one of these two edges in order to represent the binary digit 1 or 0; for 1, it uses the rising edge and for 0, the falling edge. But it only ever uses one or the other, never both.

This is where the kick-arse DDR really comes into its own bubble of authority. Working at the same frequencies SD did and would have continued along (166MHz, 200MHz, etc), instead of wasting the second clock edge, data is sent using both the rising and falling edges of the cycle using a special timing technique. In theory, this doubles the immediate bandwidth/frequency made available (hence the DDR333 and 400) to the system. However, limited by the same latency issues SD had, it hasn't truly doubled the bandwidth in the real world. This potential double increase in bandwidth is becoming far more noticeable with newer core logic chipsets and hot technology like dual-channel hitting the market.

You've probably seen the terms PC2700 (DDR333) or PC3200 (DDR400) splashed around. This is the corresponding memory's theoretical bandwidth and is calculated by multiplying the frequency by eight. Eight, because DDR (and SD) commutes data with the processor at a 64-bit increment per clock cycle. So you divide this by eight in order to get the byte count, and you're going to end up with a fantasmical eight bytes.

For example, to calculate the bandwidth for DDR400 you multiply 400 million hertz (400MHz – double pumped 200MHz bus) by eight bytes (64-bit wide data bus per clock cycle), which of course works out to be a marketing figure of 3.2GB/s. Minus the marketing it's actually a more realistic theoretical 2.98GB/s.

Apart from the funky clock doubling, one other nice change is how it's manufactured with low power consumption in mind. SD memory uses 3.3 volts whereas we saw DDR drop that down a neat 25% to 2.5 volts.

Tiny yet almighty - SPD goodness on SD (1) and DDR (2) RAM.

SOME STANDARDS

The major difference between DDR333 and DDR400, bar the bleedin' obvious is that DDR333 is fully official as it's been ratified by the Joint Electron Device Engineering Council (JEDEC) (see 'JEDEC – controlling the mayhem'). DDR400 is mentioned in some of its papers, but as it's still a nonofficial memory type, it doesn't have much information regarding it. However, JEDEC are now more seriously looking at it for a standard, seeing as Intel has now also jumped onto the DDR400 bandwagon. Forget JEDEC, we said Intel was behind it – DDR400 should have a good life.

DDR memory wouldn't be moving nearly as smoothly as it is today if it weren't for standards. If there were no central standard organisations for manufacturers, we'd have ourselves a bunch of ignorant manufacturers creating scary messes of incompatible rejects unable to utter a single binary digit of cross-breed communication.

The JEDEC memory standards control precisely what goes into a stick of memory. For example, not only what capacitor should talk to which, but in what manner and what the delay should be if any. Yup, pretty standard stuff right there. If you happen to manufacture 'solid state products', you can get in on the action and join the JEDEC for US$4,000 per year for one committee, or US$8,000 per year for unlimited committee participation. Bargain.

That said and done, JEDEC is not the be-all end-all. One particular memory module and motherboard testing lab, Computer Memory Test Labs (CMTL), has had about enough of JEDEC. CMTL has had contrasting views with JEDEC on a number of issues for some time, so it decided to announce that any products submitted to its compatibility testing program won't be required to match JEDEC's design specifications any longer.

Considering that Intel and AMD have their chips validated by CMTL, this could have massive ramifications. There's little wonder then that JEDEC has assigned itself a little task force to check out the nifty idea of having its very own compliance testing program.

Many sticks of DDR memory also go through a meticulous validation process with Intel to ensure the memory fulfills their set of DDR specifications. Suppliers can submit their memory to Intel and if the memory passes its stringent testing, it will post the results up on its Website; otherwise if the RAM fails the supplier will have to fix the problem in order to resubmit it.

Ever wondered how, when you put new memory into a system, the settings for it are automatically detected? Well

there's a technology that's now widely used called Serial Presence Detect (SPD) and is now being used in all DDR memory (bar some very dodgy sticks). This useful tech has the ability to store and identify information about itself to the system, or rather to the memory controller, regarding its current memory configuration.

An EEPROM (Electrically Erasable Programmable Read-Only Memory) is a little black chip that is used to store this information, and you can usually find it by looking on the top right hand corner above pin 92 (pin 84 on SD sticks). These were designed to allow changes to ROM chips through the method of flashing an electrical charge through the chip to reprogram it – as is done with the BIOS. Though many are actually software write protected. An advantage with EEPROMs is they won't lose any information if they aren't plugged into a power source. However if for some other reason access to the SPD is not possible (damaged/faulty/ripped off because I told you where it's located), the system will default to the safest memory settings so as not to damage anything.

DOUBLE STEROIDS ON A CHIP

Dual-channel DDR is similar in concept to memory running in a RAID-0 (striped) configuration. Basically there are two separate memory banks, as compared to the usual one, and both can have the crap sucked out of them at the same time. This is the neat increase in performance we were expecting with the coming of DDR.

However, there is only an immediately noticeable speed increase in Pentium 4 systems because speeding up the memory bandwidth on an Athlon system won't do a whole lot more than diddlysquat. Yes, operations that require direct memory access such as input/output and AGP texture bandwidth would receive a speed boost, but only noticeable in certain cases.

For statistics sake, on a Pentium 4 system running DDR333 in dual-channel, you have a potential data transfer rate of around 5.33GB/s (eight x 333MHz x two dual-channel), or 6.4GB/s for DDR400. There's some hellishly fast theory.

One thing that we need to clear up is the fact that DDR memory itself is not 'dual-channel capable'.

Any stick of DDR memory would do, as this tech is implemented in the actual mobo's chipset. So ignore any ridiculous advertising attempts that may try to sell you 'Super Fast Dual-Channel DDR' memory. However, there is actually an advantage to acquiring these, the marketing just doesn't seem to mention it. Rather surprising, considering such departments latch on to whatever morsels they can get.

You see, it is advisable that you get two identical sticks of memory, or you can have yourself a lot of problems. It should be safe to assume the memory sticks are identical when bought together as a dual-channel kit – if not I'll devour both my shoes and meow.

ATTESTATION

Now for the uber-sweet testing phase – DDR400 dual-channelism revealed in all its awe-inspiring *potential* glory. Yes, I'm being somewhat reserved here – call it a gut-feeling. Our test bench consisted of an Intel D875PBZ Bonanza board with support for DDR400 memory, a P4 3.2GHz with Hyper-Threading disabled and a 128MB GeForce FX 5200. The reason we chose this particular mobo is because it's a stock standard board with support for DDR400, providing a good baseline system.

Hyper-Threading was disabled as it is the sole reason behind many problems and it doesn't give a good representation of how a standard system would perform. Also, as we are testing memory here, we don't want another new technology interfering with the results. So out with that. Finally, the video card was chosen for the fact that it sits in the middle market, so chances are it's similar to something the average user would have.

We sourced four sets of DDR400 memory – Corsair, Crucial, Kingmax and OCZ. We normally include prices for all our hardware, but as memory prices have the tendancy to rollercoaster more than oil, we decided against putting them in. As we go to print, memory is currently on the rise again, but with its unpredictable nature, it could be falling by the time you read this.

So the ultimate question you've been begging to have answered: how does DDR400 perform in dual-channel? We'll give it bluntly to you now – DDR400 has a long way to go because presently it blows gravel like a sea-bed vacuum cleaner set to reverse.

Three of the four sticks defaulted to the 333MHz speed, and required a good degree of tweaking and bunny hopping to get them to run stable (read: at all) at 400MHz, which suggests to us that these are really repackaged DDR333 chips. Thanks to a hidden force not all of them were this bad: Kingmax spent some time to re-fab its DDR400 to actually perform at 400MHz by default (upon speculation, this was possibly via a simple change in the SPD). Unsurprisingly it ended up being the pick of the crop here, albeit by a small margin.

As any self-respecting Atomican wouldn't just leave their memory sitting at the boring default speed, we decided to benchmark after finding the sweet spot for each stick. The eventual latencies we managed to squeeze out of them were 5-2-3-2 for both Corsair and OCZ, and 5-2.5-3-2 for Crucial and Kingmax. With the fun of setting up out of the way, they were not only tested against themselves but also two sticks of DDR333 memory.

The results speak for themselves. The largest increase above DDR333 was a theoretical 27.5% rise in memory bandwidth. That is a darn good figure. In real world terms this translates to around a 10fps increase in Q3A under CPU settings, getting even better under UT2003 at just under one meager frame of improvement. Not exactly jaw-dislocating.

JEDEC – CONTROLLING THE MAYHEM

JEDEC (commonly pronounced as 'jay-deck') is an organisation of mostly manufacturers that establish standards for 'semiconductor components'. This is so the digital world won't evolve into one maniacal standard-competing jungle. It decides which path standardised technology will take and design the exact nitty-gritty specifications for them.

However on many occasions manufacturers get excited and release hardware before it is even partially ratified by JEDEC, which generally isn't a problem, as it is usually the same tech, only faster than the original. A typical example would be DDR400, as it hasn't been fully ratified yet, but it's essentially the same as DDR333, only faster – or so we hope. Though, if you remember back to when DDR333 first came out, both SiS and VIA were pushing it for several months before it became a fully ratified standard. JEDEC seem more keen on the next version of DDR headed your way soon – the ingeniously named DDR-II.

In the end, DDR is dramatically accelerating towards a distant sun, with performance increasing at a scorching rate. Unfortunately DDR400 is still building its boosters, as it's currently only overclocked DDR333 – with manufacturers trying to tap into the demand for faster memory by taking short cuts. That's if the manufacturer could be bothered to overclock it for you – otherwise you're effectively paying extra for a stick of DDR333, with the added bonus that you get to tweak it.

Our advice is if you want DDR400 right now, go for it if you're after the slightly higher numbers. Honestly though, you're better off getting a superior quality stick of DDR333 and overclocking it.

ABOVE: Two sticks of OCZ EL DDR400. Note the nice Copper colour.

ABOVE: Kingmax DDR400 – the only RAM that defaulted to 400MHz

ABOVE: Corsair TwinX XMS DDR400. Sails mean pirates, see.

ABOVE: Crucial DDR400. Yes, it's crucial you have RAM.

Unreal Tournament 2003 640 x 480 average fps

Kingmax DDR400	92.77
Corsair TwinX DDR400	92.41
Crucial DDR400	92.36
DDR333	92.03
OCZ EL DDR400	91.94

0.00 20.00 40.00 60.00 80.00 100.0
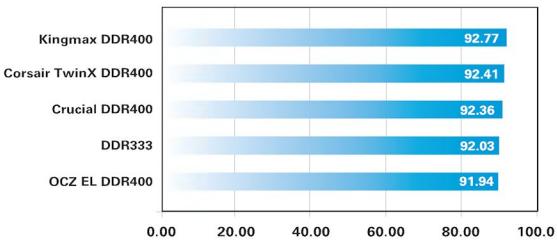
Memory Int ALU/RAM bandwidth – MB/s

Kingmax DDR400	2,917
Crucial DDR400	2,728
Corsair TwinX DDR400	2,639
OCZ EL DDR400	2,580
DDR333	2,287

0.00 500 1,000 1,500 2,000 2,500 3,000 3,500
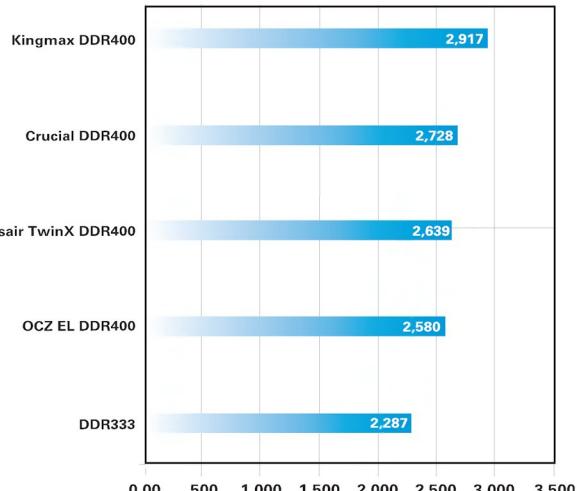
Quake 3: Arena 640 x 480 average fps

Kingmax DDR400	375.2
Crucial DDR400	373.3
Corsair TwinX DDR400	372.4
OCZ EL DDR400	367.8
DDR333	364

0.00 100 200 300 400
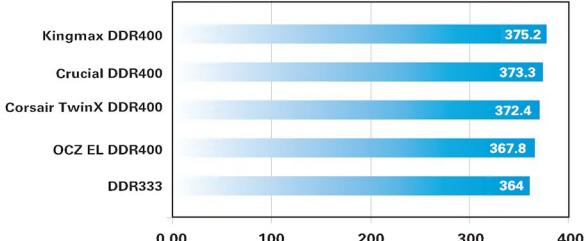
Most work boots have a strap attached to the top for ease of pulling on. Yes, we *are* talking about shoes here. Well the term 'boot your computer' is actually derived from the expression 'pull oneself up by one's bootstraps'. Early computer engineers adopted the term 'bootstrap' (shortened to 'boot' – we all have lazy tendencies) because after initially being turned on, the computers were capable of self-executing particular commands when required. Highly advanced stuff.

Silent emissions

Hot chicks with mobile phones. That's right, researchers have found that EM radiation (like that from cell phones) can 'cook' the embryos in chicken eggs. We sent Ty Pendlebury to find out how much our beloved boxes radiantly radiate.

Windows and Perspex cases are here to stay. And it's a good thing too, as it's taken a bloody long time for PC manufacturers to cotton on to the idea that no one likes beige. No one.

PCs are bleeding into every room of the house, but are today's cases disgorging more than just tech into our homes? Bucketfuls of fans, increasing CPU speeds, Bluetooth and Wi-Fi transmitters are all generating radio frequency, and the prevalence of unshielded casings is only adding to this.

Since WWII, scientists have investigated the effects of radio frequency (RF) on humans, after military radio operators reported 'feeling warm' when operating their equipment. Countless studies have followed: the effects of power lines on Tongan children; EMF emissions in the workplace; and now mobile phone emissions.

The idea that RF could be used as a weapon soon followed. In the 50s, military scientists experimented with the effects of extremely low frequency (ELF) on humans, and

C-Tick: The C-Tick denotes compliance with Australian EMC standards.

the potential for creating a mega 'ELF cannon'. But due to the massive amount of energy needed to create sub-audible frequencies it didn't have much of a range, and the weapon was shelved. However, another recent invention, hypersonic sound, has piqued the interest of the military once again. It uses several high-frequency beams which, when targeted at an object, becomes sound. Though it was designed as a directional, domestic device, it could also be used to focus a debilitating loud or destructive sound at targets without affecting the immediate environment.

Eric Cartman taught us that certain types of frequencies adversely affect the human body. He attempted to recreate 'brown noise', a sound causing everyone who heard it to, er, well, you get the picture. Nerves and muscles operate on very low frequency electrical impulses, and they could become confused if those frequencies were replicated.

Meanwhile, mobile technology's effects on human tissue are still a matter of hot debate. Some studies say it's safe while others say it's carcinogenic. If low frequencies and microwaves can affect the environment, and us, surely any sort of electromagnetic frequency (EMF) could have ramifications.

RF is one of two types of radiation – non-ionising radiation

NON-IONIZING RADIATION ← → IONIZING RADIATION

| Low induced currents No proven effect at environmental levels | High induced currents Heating | Electric excitation Photochemical effects | Broken bonds DNA damage |

← WAVELENGTH (metres)

1km	1m	1mm	1um	1nm
10^6				
	1	10^{-3}	10^{-6}	10^{-9}	10^{-12}	10^{-15}
10^3				

| Low Freq. | Radio Waves | *u*wave | Infrared | UV | X-, Gamma and Cosmic Rays |

| 0 | 10^3 | 10^6 | 10^9 | 300 | 10^{12} | 10^{15} | 10^{18} | 10^{21} | 10^{24} |
| | 1khz | 1Mhz | 1Ghz | | | Visible | | | |

FREQUENCY (hertz) →

Power lines — AM — TV/FM — uwave ovens — Heating Lamps — Tanning Booths — Tanning Booths — Medical X-Rays
Mobile Phones — Traffic Radars — Laser Radars

– while the other is known as ionising radiation. Radiation types in frequency up to ultraviolet (UV) rays are non-ionising, while UV radiation, X-rays, gamma rays and cosmic rays are ionising. Ionising radiation breaks carbon bonds in the molecular structure of organic cells, and that's bad, ok? Non-ionising radiation is thought by some to have little medical effects, while ionising radiation is known to have significant health effects with prolonged exposure, for example, cancer.

Until Thomas Edison invented the light bulb, radiation existed only in a natural state – during events like lightning strikes. It might sound kind of dumb and science-fiction-y to those reading this, but over half of our exposure to radiation comes from decaying uranium and cosmic rays. Uranium produces Radon gas which leaches into the soil and ultimately collects inside buildings.

While the frequency of EMF seems to have an influence on its effects, the relative power output is also important and due to the inverse square law, so is a user's proximity to it. EMF is subject to the inverse square law, which means as the distance doubles the strength of the field is reduced by a quarter.

There are two main units used when describing amounts of EMF: low frequency/long wavelength radiation is usually measured in terms of the strength of the magnetic field (in gauss or milli-gauss); while higher frequency radiation is described in terms of the amount energy absorbed by the body (in Sieverts). The unit of measurement varies with the type of radiation, and unfortunately no single instrument is able to measure across the whole spectrum.

Exposure levels to EMFs around the home are in the range of 0.1-2.5 milligauss, while for homes near or under high-tension powerlines, these levels can vary as much as 5-100 milligauss.

The current standard governing RF generators covers the potential biological and environmental effects of certain frequencies. This standard is the culmination of efforts by several organisations, including Standards Australia, the Australian Radiation Protection And Nuclear Safety Agency (ARPANSA) and the Australian Communications Authority.

In 1997, the ACA introduced the EMC (Electromagnetic Compatibility) Compliance scheme, which was designed to limit the amount of electromagnetic interference according to the Radiocommunications Act of 1992.

In 1998 the ACA changed this to a self-regulated system, with the onus on manufacturers to ensure their products met the standard. Obviously, loopholes emerged and this was scrapped in the same year.

In January 1999, the regulations were rewritten so that the scheme became totally standards based, and the C-Tick became compulsory on applicable electronic items. A C-Tick (see diagram) is essentially a mark identifying that the device meets Australian EMI standards.

The standard is based on the International Commission of Non-Ionising Radiation Protection (ICNRP), which aims to regulate according to frequency. It also doesn't allow some devices into the country as they emit over the previous limit (which was 200mW/cm² – the amount of microwatts per square centimeter – which mobiles safely emit under).

The main generators of RF in a common computer are the monitor, the power supply, the processor (which is increasingly prominent as core frequencies increase), and the add-in cards and drives.

The humble CRT monitor has long been the scourge of the PC world – at least in the litigators' minds. In the 70s and 80s the CRT was linked to miscarriages in women and other effects, and several studies were conducted but little was proven. At the present time, the CRT is still the highest generator of EMF: for example a 17in CRT can produce 7-9 milligauss, while in comparison a 15in LCD produce around 0.1 milligauss.

The main RF outputs of a CRT, however, is not from the screen but from the back and sides. The screen itself acts like an air ioniser, as it attracts dust particles – potentially benefiting your health!

The total emission level of your average computer is up to 20 milligauss. The average user – sitting at arm's length would cop a dose of around two milligauss.

RF interference isn't the first thing on most computer modders' minds, it just happens to be incidental to showing off really cool gear. But what is with all the warnings? Are there risks involved with unshielded computers?

Perspex cases can only be used for 'demonstration' purposes, according to the few Australian distributors who stock them, as they are useless at shielding RF signals. Perspex windows are also bad at containing RF.

The Australian Communications Authority (ACA) helps regulate the emissions of electronic products, and says it's perfectly legal to sell unshielded PC cases in Australia: 'A plastic case may be supplied to the market legally. If it contains a power supply the power supply must be C-Ticked on its external surface', says Ian Rogers of the ACA.

It appears the manufacturers get around Radio Frequency Interference (RFI) regulations by shipping their cases without a power supply. If there's no PSU – there's nothing to test, and it doesn't need to meet any guidelines. Taiwanese manufacturer Lian Li is unusual among case makers because it has taken the extra precaution of adding an

Labels on illustration: Cosmic Rays, CRT Monitor, Fluorescent, Computer housing, Mobile Phone, Digital Cordless 2.4 Ghz phone, Mouse, Powerboard

aluminium cover to its windowed panels.

C-Ticked components are all tested in a metal case, Rogers says, which 'will afford a degree of shielding not provided by the plastic version'. But, theoretically, a Perspex case decked out with C-Tick compliant devices would also be compliant. Ian Rogers says that ordinary users who buy these cases aren't, therefore, breaking the law, 'unless they are knowingly causing interference and disobey a warning from the ACA.'

The ACA will issue a warning if it receives a complaint from a member of the public, and upon investigation find that the complaint is justified – for example if your regular LAN sessions interfere with your neighbour's late-night talkback listening. This could possibly lead to fines or prosecution if a user knowingly causes interference, and disobeys a warning from the ACA, Rogers says.

The ideal PC case from an RF perspective is the Faraday cage – being an enclosed steel box. Obviously this would be useless for housing a PC, with its need for heat dissipation. The actual cage uses metal pins or fingers to connect the walls of the box – in this case the sliding panels of the PC – in a certain frequency and location to provide minimal resistance, while also maximising the reduction of selected frequencies. This allows insulation from RF while also allowing ventilation. Total metal-to-metal contact is the most important part of the concept, which is why many cases – with their metal-to-plastic contact – are poor insulators.

Stewart Fist, IT journalist and EMF expert, says the cases on most computers do very little to stop external interference as a result: 'The reason they usually put shielding around the computer itself is to stop the ingress, so that someone using a cell phone handset alongside is not going to knock the hell out of the chips.'

'If there was interference from one component to another it wouldn't work. You can't have anything in there that is interfering otherwise a computer just wouldn't work. Don't forget the components are sitting right alongside each other and they're not shielded,' Fist adds

Ordinary metal cases, if poorly designed, can actually be RF beacons. If, for example, a metal aperture exists in the casework with the same dimensions as metal antenna, then a 'slot' antenna is created. In this instance you probably are better off with no case at all.

At times, hardware manufacturers can, in effect, cripple the capabilities of PC components in their bid to reduce RF output. The GeForce2's were famous for fuzziness at certain resolutions, which was actually caused by their RF filter circuitry. Several Websites posted hardware hacks that supposedly improve the quality of the image (but also obviously increase the amount of RF these cards produced). Certain Athlon XP chips were also given a transistor count boost during its race against the impending 3.06 Pentium 4 – but not in the name of grunt – in the name of RF friendliness.

One of the most obvious hazards when using a poorly-
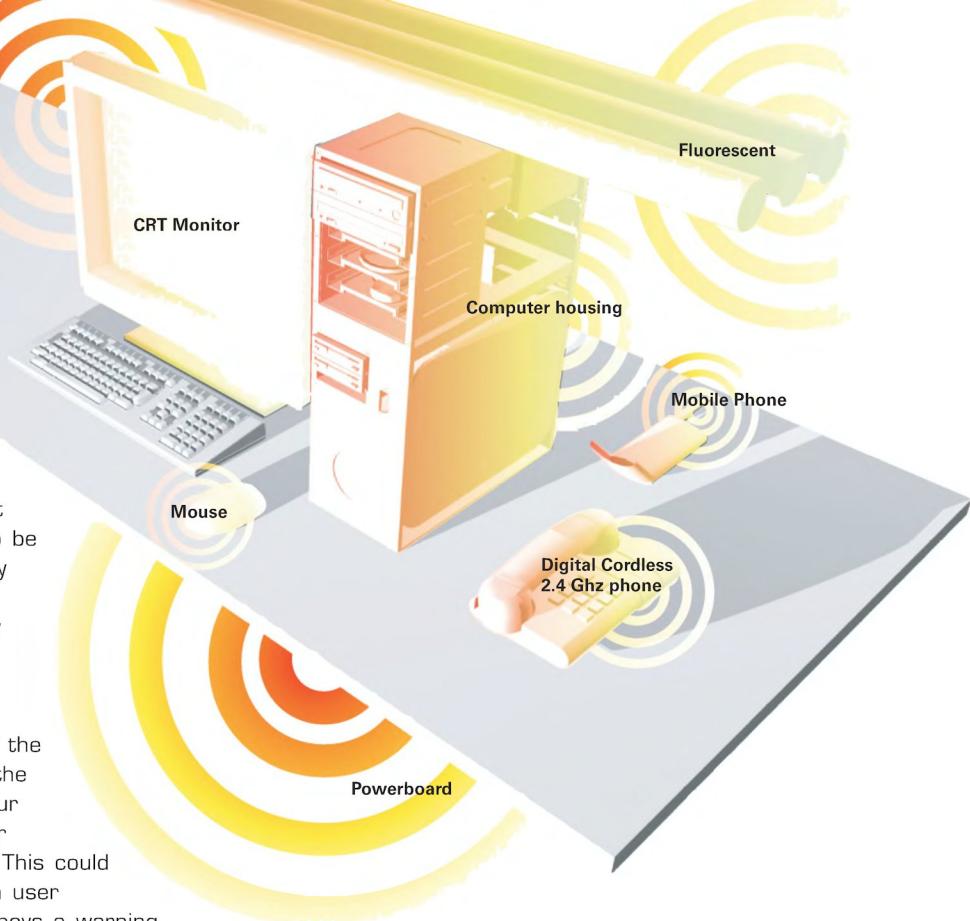
ABOVE: Your computer desk - once the only place you really ever felt safe - is killing you slowly with radioactive love.

shielded PC is Radio Frequency Interference (RFI). With PC's this RFI is most evident when listening to AM radio.

Radio Frequency Interference or RFI is one of the most common side effects of RF generators. Analog devices that operate with RF are the most prone to RFI: amateur radios, analog TV, AM radio, Copper-pair phone lines. It's not always the main frequency that can cause effects, but the harmonics – higher or lower frequencies that 'harmonise' with the main frequency output.

This is why CPU clocks can interfere with AM radio – the radio isn't running in the gigahertz range, and usually the RF output of the chip isn't either, but a harmonic frequency generated by the clock can run at the same frequency as an AM station. AM radios shouldn't receive RFI if they're beyond a certain distance – unless you have a pretty crappy power supply, which is perhaps also creating interference of the mains supply. Power factor correction PSUs are seen as a method of combating RFI in cases, as they minimise the 'dirtying' effect on mains supply and reduce HF noise.

Apart from environmental effects, RF can also have physical effects. The most often discussed is the 'heating effect'. Like, microwave ovens, certain EMF's can cause an excitation of cell particles, causing them to heat. This is what the recent IRCNP standard protects against – the immediate heating effect of exposure to EMF – 'zapping' or cooking effects.

The matter for debate is whether RF does indeed have detrimental effects. The mobile phone manufacturers will almost certainly tell you the levels of radiation from mobiles and wireless devices are within 'safe limits', but who is the judge of these?

The human body has a natural resonant frequency, and RF energy is much more efficiently absorbed if it is at or near this frequency: this results in the maximum heating

effect. In adults, it is about 35MHz if they are grounded and about 70MHz if not. Body parts can also resonate – an adult's head resonates at around 400MHz while a baby's resonates at 700MHz.

Bluetooth and Wi-Fi are tipped to be the major new advance in computing over the next few years, with heavyweights such as Intel heavily pushing their Centrino product. As you may know, these technologies are based on microwaves just as mobile handsets are. One of the concerns raised is that if mobiles are potential killers then so are devices such as Bluetooth mice and headsets. Mobile handsets can generate up to 2W of output power, while Bluetooth and Wi-Fi can generate up to 0.1W per device. Meanwhile, Digital cordless phones based on the DECT standard operate at 0.25 Watt

The main difference, especially with headsets is that they are worn all the time. Standards Australia advisor and RF consultant Don Maisch says wireless technology is potentially a new battleground, particularly in wireless dependent workplaces: 'There's a lot of concern being expressed about wireless headsets, like say somebody in a call centre, they've got a headset plugged into the computer. Ok, eight hours a day, five days a week. What is the assurance of safety? There really isn't any. So in other words, we're all sort of guinea pigs. We can't say that this technology is definitely a health hazard, but there's a lot of evidence that shows that we have to be very cautious. But that's just not happening.

'All these higher speed computers, wireless computers.

Deluxe Shielding Dress Shirt is one item which, according to its Website www.lessemf.com, is both 'Handsome and Comfortable. At last, you can look good and shield yourself too!' That is, if scratchy metal fibres woven into your shirt are your thing.

'Certainly there are people having problems with computers, but generally I think: we have motor vehicles, they're obviously a hazard too. But they're a part of society. Computers too are a part of society so it's a matter of limiting the possible health effects as much as physically possible,' he says

ARPANSA has done extensive research on the effects of 50Hz radiation (mains electricity) on humans, as well as mobile phone emissions. ARPANSA's Brendan Elliot says all of the items in a domestic house are relatively safe. He says it's only the unshielded, high-current devices, such as fridges and radiators which generate high enough fields to be concerned about. He says even then, most people don't sit near enough for it to be a problem anyway. He says there are little risks involved with unshielded casing, 'not when compared with the risk of electrocution' from tinkering around inside the case

So what can concerned users do to minimise the effects of RF generated by their PC's? Consultant Don Maisch says it's best not to sit 'right on top of it': 'I have a viewpoint that if you're using a modern computer and as long as you're sitting well back, the radiation is fairly low. I say to people: first of all, have good ventilation, and to reduce RF levels, really, just sit back from the computer. So basically I advise people if you reach out and you can't quite touch the screen then that's a good distance. You can see the radiation levels drop very fast as you move away from your computer.'

A good rough-and-ready RF detector is the humble AM radio. A portable one is probably best. Just try shoving it in and around your PC – whiny noises or 'chuggy' static will indicate RF leakage.

If you find the monitor is causing a lot of EMF, obviously either move it further away or buy an

RADIATION

Common sources of EMF	Typical measurement at typical user distance (in milligauss)	Typical maximum measurement at source (in milligauss)
PC	5	20
Television	1	13
Electric Blanket	20	30
Fridge	2	5
Mobile phones (at caller head position)	50	300
Transmission power lines	20	200
Desktop light	33	-
Portable heater	1.4	20
Computer monitor (sizedependent)	9	134
LCD monitor	0.1	-

What's going to be the health effects there? I certainly wouldn't want to be using them', Maisch says.

Swedish researchers AMA-Konsult, suggest some PC users may be EMF hypersensitive, and sitting at a computer can trigger symptoms similar to other allergies, such as skin rashes, headaches and tiredness. The research suggests EMF can trigger the stress hormones such as testosterone, prolactine, and thyroxine in these people.

'I think there are people who are very sensitive, I've certainly met a lot of people who are very sensitive to low levels of RF. The same thing you could say as there's people who are very sensitive to peanuts, they're very common allergies,' Don Maisch says.

Concerns over EMF exposure have lead to a little cottage industry, providing products that may or may not protect the user, but as Don Maisch puts it 'comfort the consumer'. The

LCD screen. Meanwhile, that PC case full of neon loveliness doesn't usually sit too close to you anyway, so you can either move it, or forego some of its glory, and invest in a sturdy steel case

There may be no solid evidence to suggest there are health risks from electromagnetic fields or mobile emissions, but the question is: would you want to live next to a power substation or have a mobile tower on your roof? Similarly, the effects of wireless technology and unshielded PC components are as yet unproved.

But then again, if you worry about every little thing giving you cancer, then its more likely to have some sort of psychosomatic effect – become a self-fulfilling prophecy. At least users can feel safe in the meantime buying windowed and Perspex cases, because if the ACA doesn't know about you, then you can't be doing anything wrong. Right?

M☼DWARE

PC's are no longer boring. At Anyware, we distribute a wide range of special PC cases, lights, coolers, fan grills and other case modding gear. We call this MODWARE™. As a wholesaler, however, we do not sell directly to the public. Please ask your local PC dealer for stock and price information. Alternatively, you may contact one of the resellers below.

RESELLERS

VIC			WA			QLD			NSW		
Digiworld	Melbourne	03-9663 6699	Austin Computers	Osborne Park	08-9201 2788	Quality & Innovation	Brisbane City	07-3220 2500	BusyBits	www.busybits.com.au	
Scorpion Technology	Burwood East	03-9886 1615	PLE Computers	Wangara	08-9309-4771	Karana Computers	Chuwar	07-3812 5211	AusPCMarket	www.auspcmarket.com.au	
PC Case Gear	www.pccasegear.com.au		Navada Computers	Osborne Park	08 9446 4099	Add To Computers	CAIRNS	07-4031 6883	ECOM computers	Sydney City	02 9299 0022
Computers & Parts Land	Notting Hill	03-9548 7088	NetPlus Micro	Osborne Park	08 9242 7288	TNQ	Mossman	07-4098 3888	Computer Interchange	Chatswood	02 9411 4144
ACT			NT						Microtech Corporation	Auburn	02 9648 1818
Ailean	Phillip	02 6257 1717	Tec Chips	Coconut Grove	08-8948 3663				Upgrade Yourself	Dee Why	02 9982 9939
									Equipt	Sans Souci	02 9593 4776

SA

Duncan Computers	Adelaide	08 8212 6600
Adrenalin Computers	Adelaide	08 8410 0777
Boost Computers	Adelaide	08 8410-2722
Cherry Computers	Adelaide	08 8232 5700

Anyware™ COMPUTER ACCESSORIES   www.anyware.com.au

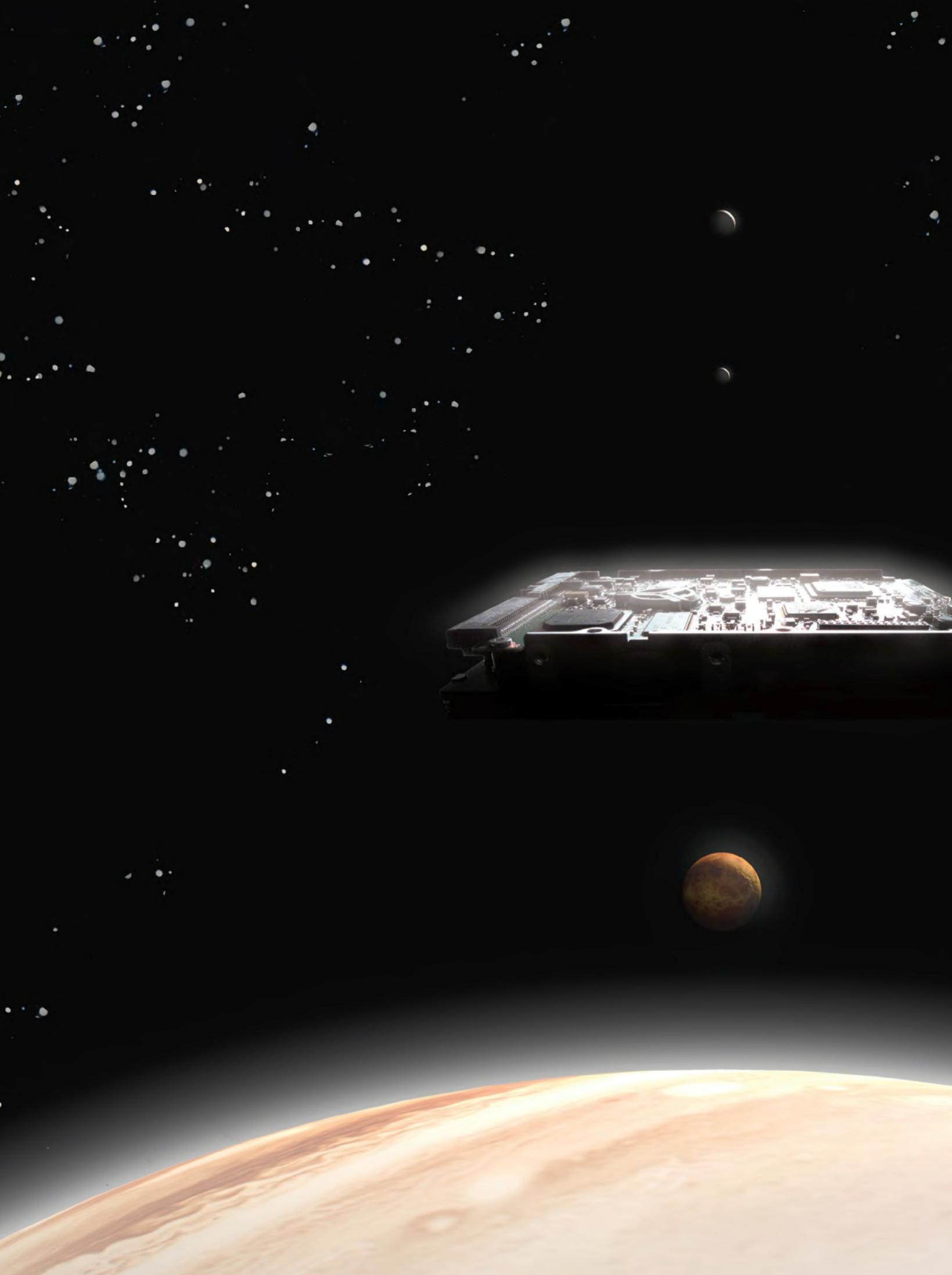| SYDNEY	MELBOURNE	PERTH	ADELAIDE	BRISBANE
TEL: 02-9879 5788 FAX: 02-9879 5388	TEL: 03-9763 8200 FAX: 03-9763 8400	TEL: 08-9242 8588 FAX: 08-9242 8688	TEL: 08-8347 0488 FAX: 08-8347 0466	TEL: 07-3856 3999 FAX: 07-3856 1777

THE
HARD DRIVE
OF MEMORY

Ever since Wesley Crusher discovered that he could store all his hardcore Deanna Troi porn on a single optic chip, geeks around the world have dreamed of viable holo-storage. Dr Carlo Kopp explores the niftiness of persistent memory and holographic bulk storage.

System storage, be it main memory, disk or tape, seldom attracts the visibility that developments in CPU and GPU technology produce. Nevertheless, the performance, cost and capabilities of main memory and bulk storage are critical to achieving high performance in a system, be it a fanatical gamer's desktop or a large server.

Existing DRAM technology is what can be termed 'non-persistent' or 'volatile' in that removing the electrical power driving the DRAM results in complete loss of the stored data. This is an inherent result of the circuit technique and device technology used. With DRAM each bit of data is typically stored as electrical charge in a capacitor – usually implemented with a CMOS or NMOS transistor. That charge leaks out relatively quickly, so modern DRAMs include 'refresh logic' circuits which periodically read the contents of each bit in the DRAM and 'refresh' it by topping up the charge if the device needs it.

VOLATILE MAGNETS

Volatility in DRAM technology is a nuisance we have learned to live with, and with a crap-house operating system or application producing frequent BSODs or 'bus errors' this is a nuisance most users can do without. Of bigger concern for many today is life in a world of deregulated electricity suppliers, who often provide mains power with daily dips, brownouts, glitches and dropouts. While an uninterruptable power supply (UPS) is a viable fix, it is an expensive fix and not as widely used as one might suspect.

Users of laptops and notebooks also have to deal with the realities of intermittent operation, and the standby modes in most such devices still result in appreciable power drain. While battery technology has improved remarkably in recent years, the laptop or notebook user will often end up with a beeping system, and their work vaporised before they can save it. Must users continue to live with the impediments of volatile main memory?

During the 1960s and early 1970s the dominant technology for main memories was based on magnetic cores rather than solid state transistors. Magnetic core memories were genuinely non-volatile or persistent. Remove the power and whatever was last stored in the memory remained in the memory until the system was powered up again and one or another application, such as a booting operating system, overwrote it. Magnetic core memories were small, slow and expensive and in today's world represent mostly a curiosity – although some of these museum pieces have remained in operation in some obsolescent military equipment.
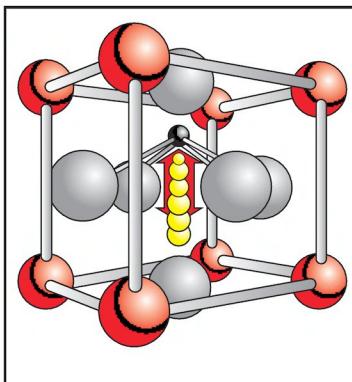
There is an anecdote, the veracity of which is unclear, which claims the core memories from the mission computers in the ill-fated Space Shuttle Challenger were fished out of the water, cleaned, hooked up into a testbed, and read out to establish what the computers believed was happening during the final milliseconds of the vehicle's life.

Until recently there have been only two robust non-volatile memory technologies, the FLASH and EEPROM (Electrically Erasable Programmable Read Only Memory) which has been widely used for storing configuration data in computer boards, but also mobile phones, microwaves and other consumer products. The limitation of FLASH/EEPROM technology has been in its slow write cycle – even if it is competitive in read access times, it is slow to write. This asymmetry in timing, a propensity to wear out after a number of writes and cost make it non-viable as a candidate for a non-volatile DRAM replacement.

More recently chip designers and device physicists have made significant progress with three technologies, all of which are candidates for a full speed non-volatile main memory array. DRAM and FLASH occupy a US$20 billion annual market segment.

FERRO-ELECTRIC RAM

The FRAM (Ferro-Electric Random Access Memory) has been produced and marketed by Ramtron International in Colorado since the early 1990s, but until recently the density of these devices has relegated them to specialised low volume uses.

FRAM, like DRAM, uses a capacitor structure to store a '1' or '0' but unlike DRAM, which uses a conventional Silicon dioxide capacitor fabricated on the die, the FRAM uses a capacitor with a ferro-electric crystal material.

Ferro-electric materials (see illustration), such as Lead-Zirconium-Titanate (PZT) have the interesting ability to hold an electrical charge indefinitely. The mechanism via which this occurs is in the crystalline lattice itself, as a central atom within the lattice can flip its position when an electric field is applied. If a capacitor is fabricated using a ferro-electric material as the dielectric then this capacitor will retain the electrical orientation resulting from the polarity of the electrical charge applied. The result of this is a mechanism via which a non-volatile memory cell can be produced as the capacitor retains its induced polarity even after power is removed.

When a ferro-electric cell is read, an electric field is applied. A current pulse results and its size will depend on the orientation of the stored state of the ferro-electric cell. If the atoms have to flip orientation a large pulse is produced, if they do not a small pulse is produced, and this is used to sense a '1' or a '0'. The read operation wipes the stored information in the cell, and therefore a refresh circuit is used to write it back into the cell.

Fabricating an FRAM is much trickier than fabricating a conventional DRAM, the Silicon die with the read/write and addressing circuits must have a layer of ferro-electric material applied to it, and this material has to be etched differently from the die material to produce the individual bit level memory cells.

An advantage of FRAM technology is that it can be applied to portions of 'conventional' chips such as microprocessors or signal processors, and is likely to become a feature of many future embedded processors.

Until recently FRAMs were fabricated with 0.5 micron technology, and this did not produce a product competitive with DRAM chips. The best reported size for an FRAM has been a 64-megabit (8MB) device fabricated by Texas Instruments using 0.13 micron technology.
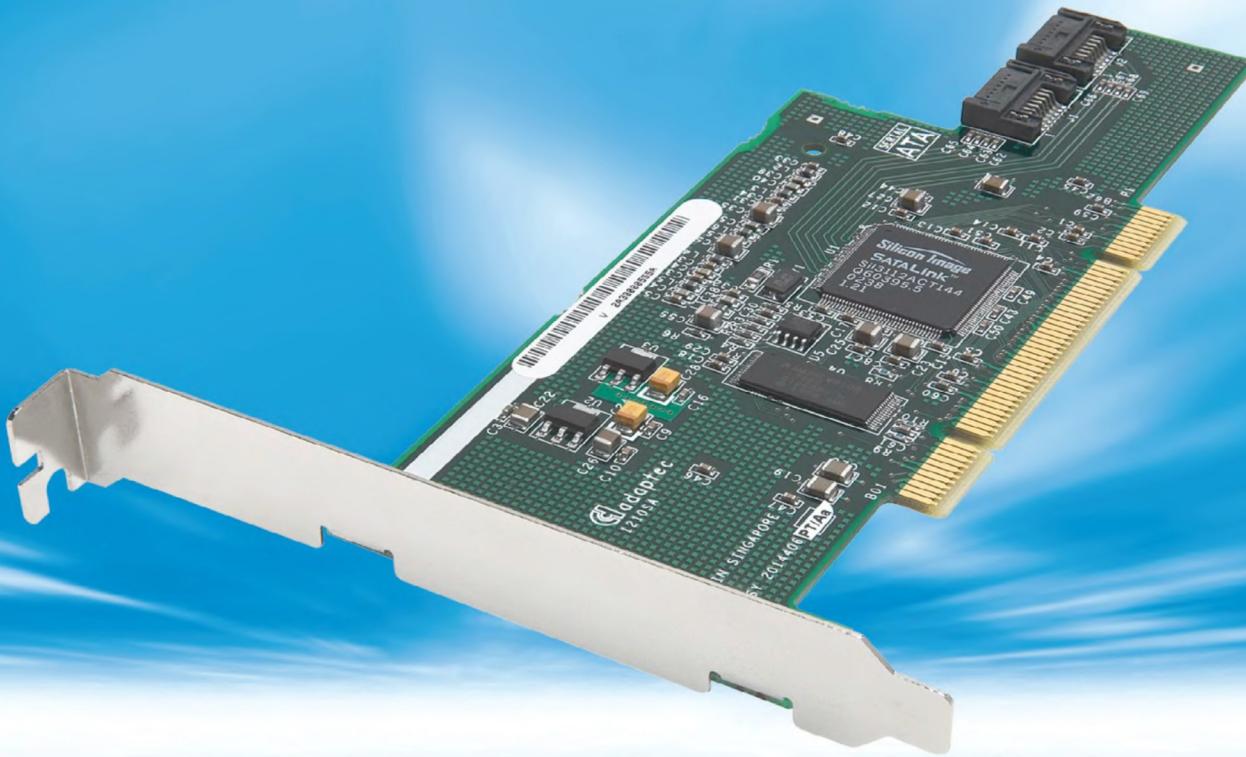
OVONIC UNIFIED MEMORY

Ovonic memory technology has a history even older than the FRAM, and was first proposed by Stanford Ovshinky during the 1960s. The mechanism it uses is quite different from the FRAM, and shares more in common with rewritable CD/DVD technology. The alloy used in current Ovonic memories was originally developed for the CD/DVD market.
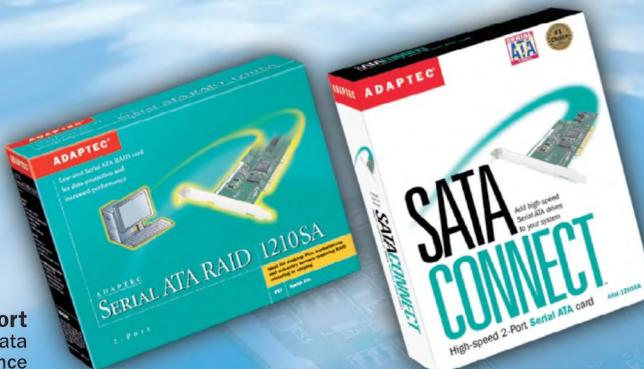
Ovonic memories make use of alloys termed chalcogenides that can very quickly change between a crystalline and amorphous state when heated. What is important is that the chalcogenide has quite different electrical behaviour in either the crystalline or amorphous state – when crystalline it has low electrical resistance, when amorphous it has typically 100-fold higher resistance. Therefore the crystalline or amorphous state of an Ovonic memory cell is used to store either a '1' or a '0' (see illustration).

A typical Ovonic memory cell will be fabricated from an alloy of Germanium, Antimony and Tellurium. The alloy

storage cell is fabricated on top of a miniature resistive heater element which is controlled by a drive circuit.

Writing to an Ovonic memory cell involves driving the resistive heater in a manner that either produces a crystalline or amorphous state within the chalcogenide alloy cell. Heating the cell and allowing it to cool immediately causes the alloy to become amorphous, whereas maintaining it just below its melting point for 50 nanoseconds causes the alloy to become crystalline. Thus either a '1' or a '0' is written.

insulator separates two layers of a magnetic material (see illustration). The magnetic layers forming the top and bottom of the magnetic 'sandwich' can have their magnetic fields aligned either in a parallel or anti-parallel direction. When the fields are aligned in parallel, the insulator has a lower electrical resistance compared to the state where the fields are aligned in an anti-parallel sense. Therefore the parallel or anti-parallel sense of the magnetic fields is used to store either a '1' or a '0' in the cell.

MagRAM Architecture

Reading a bit

Work line

Bit line

Writing '1'

Writing '0'

Work line

Bit line

Bit line

MTJ MagRAM promises

* **density of DRAM**
* **speed of SRAM**
* **non-volatility**

MagRAM uses a cross-point architecture for reading and writing – words are addressed by one set of wires, with a perpendicular set addressing each bit. The arrangement is not unlike a crossbar telephone switch.

To write a specific bit in MagRAM, an electrical current is passed through the word and bit address wires – the cell at which they intersect is subjected to a magnetic field which reorients the state of the cell and stores either a '1' or a '0'.

To read a specific bit in MagRAM, an electrical voltage is applied to the word line and the current flowing through the cell is sensed on the bit line. Depending on the magnetic state of the cell, either a weaker or stronger current will flow and this is used to
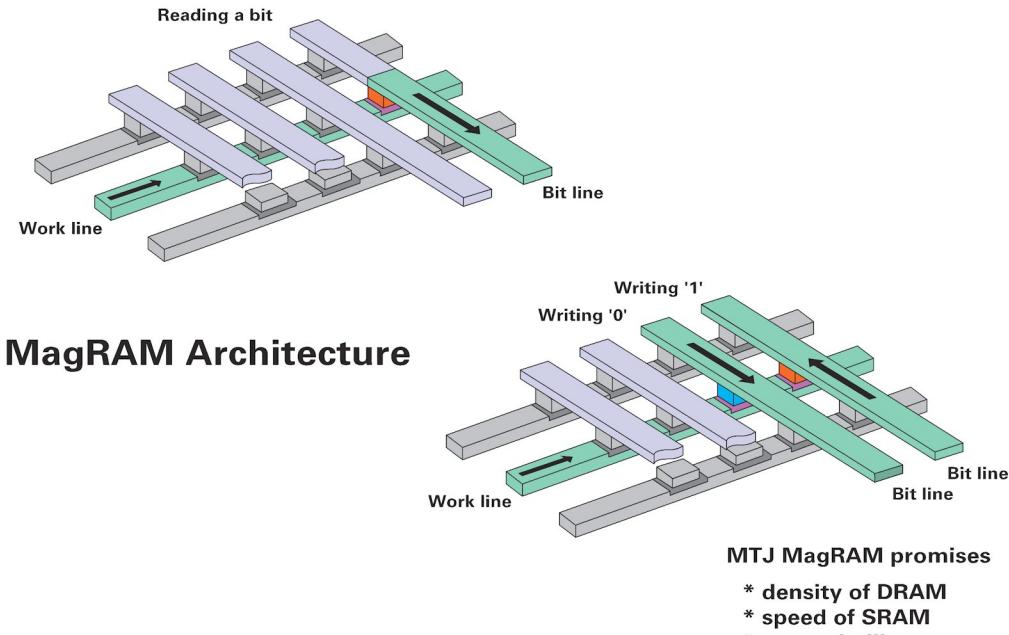
Reading is much simpler, since the readout circuit merely needs to sense the electrical resistance of the Ovonic cell – a range of fast techniques will exist to do so.

Ovonic memories are a more complex technology than FRAMs and to date the largest reported memory size is 4-megabits. Scaling these devices to smaller geometries and densities will reduce the required heating power per cell, so the current expectation is that much higher densities can be achieved. US industry reports indicate that Intel have partnered with Ovonyx, the developer of this technology, with the evident aim of eventually replacing their existing FLASH technology business.

sense whether a '1' or a '0' has been stored.

The development of the MagRAM has been time consuming and expensive, with IBM and Motorola leading players in this market. In particular, the choice of materials suitable for the magnetic sandwich has proved difficult.

IBM researchers at Almaden in California claim that they have achieved speeds in MagRAMs which are up to six times faster than conventional DRAMs – in effect producing devices which in performance compete directly with static RAMs or SRAMs – the technology of choice for caches rather than main memories. The MagRAM is genuinely non-volatile not

■ MAGNETIC RAM

MRAM, often labelled 'MagRAM', is in many respects a 'back to the future' technology – a high technology high density high speed magnetic storage memory with the best qualities of the defunct core memory and performance to embarrass the best DRAMs.

MagRAM is derived from the high density magnetic read head technology that has produced the large density gains we have seen over recent years in hard disks.

In a MagRAM device, each storage cell uses a Magnetic Tunnel Junction – a structure in which a very thin layer of

'. . ."MagRAM", is in many respects a 'back to the future' technology – a high technology high density high speed magnetic storage. . .'

unlike a 1960s magnetic core memory.

The remaining challenge for MagRAM is achieving competitive density and pricing against existing commodity DRAMs.

HARD DISK STORAGE DEVELOPMENTS

Without doubt the most important technological development to hit the disk drive market in the last five years was the 'spin valve' or 'giant magneto-resistance' effect read head. Pioneered by IBM, this technology has since been adopted across the disk drive market and is now the defacto industry standard.

Conventional disk drive heads in the early days employed miniature electrical coils for both writing and reading of data into the magnetic coating on disk platters. It was very soon found that with increasing density of data less and less magnetic flux was produced per bit of data, and in turn set practical limits on how much data could be read from the disk before errors swamped the '1's and '0's.

The next important development in this area was the adoption of the magneto-resistive (MR) read head, the technology which was the basis of the typical two to four-gigabyte 3.5in disk that was the market standard five years ago. In a typical MR drive head, writing is performed by a coil, but reading employs an MR sensor made from a ferromagnetic alloy. The resistance of the MR elements changes with the magnetic flux it encounters on the platter, and by passing a small current through it, voltage changes are produced. These can then be amplified by a head amplifier.

The GMR effect occurs in sandwiched multilayered structures of alloys, such as permalloy/copper/permalloy, and provides typically fives times the resistance change per flux change in comparison with established MR head technology. In practical terms, this means that a similar electrical output can be produced for a magnetic recording which is about fives times weaker than established technology.

IBM more recently managed to quadruple the storage density of their drives by introducing a three-atom thick layer of Ruthenium, a precious metal similar to Platinum. Dubbed 'pixie dust' it was the technology which broke the 100GB barrier in 3.5in drives.

While improvements such as GMR heads and antiferromagnetically coupled media such as pixie dust allow more data to be crammed on the industry standard 3.5in drive platter, and thus permit higher data transfer rates once the drive head is sitting over the data blocks of interest, none of these clever technologies can overcome the basic mechanical limitations of the rotating platter drive.

The access time of any disk drive is limited by the rotational speed or rpm of the platters, and the seek time of the head assembly. Seek times remain in the millisecond range and are unlikely to change dramatically as mechanical inertia of the heads is the limiting factor.

We have seen some interesting developments in drive rotational speeds, as the industry standard 3,600rpm drive was superceded by a gaggle of 4,500 and 5,400rpm drives, in turn superceded by 7,200rpm drives. The current top end of the market, usually with SCSI interfaces, spins at 10,000 to 15,000rpm. While this might seem an impressive performance gain for a half decade, placing it in context it really means at best a roughly fourfold improvement in rotational latency.

While we can expect to see ongoing growth in the capacity of hard drives and improving gigabyte per dollar figures, we are unlikely to see dramatic gains in mechanically limited access times. Let us assume a drive which spins at 30,000rpm – its latency will be on average a mere one millisecond – but its track to track head seek time may still be two milliseconds. Without dramatic improvements in head seek times, further increases in rpm may not yield great performance gains.

To really effect a major change, fast mass storage will require some fundamentally new technology. The most likely challenge to the magnetic hard drives will come from holographic storage devices.

When we eventually see mass production MagRAMs, expect to see a device which is several times faster than the DRAMs we love and know, and robustly non-volatile to boot. While holographic bulk storage is usually regarded to be a *Babylon 5* or *Star Trek* technology, the truth is much less dramatic and the technology is now approaching a standard where it may become commercially viable inside the decade. Importantly, the idea itself is not only applicable to the storage cube of sci-fi soapies, apologies to Trekkers and B-5ers, but when applied to more conventional media such as CD-Rs or DVDs, can further enhance storage densities over and above what we are accustomed to.

■ HOLOGRAPHIC STORAGE DEVICES

The fundamental idea behind all holographic storage media is that of using an electro-optical crystal, to trap optical interference patterns produced by two laser beams, one of which is spatially modulated with data.

Most readers will be familiar with the planar hologram, produced on a flat film by combining a direct 'reference beam' of laser light, and a so called 'object beam' which is reflected off an imaged object. The two laser beams interfere, and the resulting interference fringes are recorded on the planar film. When the film is developed, illuminating it with a 'readout beam' causes reflections off the interference fringes recorded in the film, and these reflections create the illusion of a 3D spatial image in front of or behind the film.

Holographic techniques employ the same principles, but their operation is cleverer. The simplest example is the bulk or volume hologram (see diagram), commonly used for experimental work in this area and a likely candidate for IBM's future product being developed at Almaden.

In such a bulk hologram, a crystal of a photorefractive material, such Lithium Niobate, is doped with iron or rare earth ions, in a process not unlike that in which semiconductors are made. A piece of this material is then cut into a cube, slab or similar regular shape and polished.

Such crystals have an interesting optical property, which is that variations in applied light such as interference patterns produce a relatively long lived localised variation in the index of refraction of the crystal. In the simplest of terms, the material can 'remember' an applied interference pattern. This effect is produced by charge within the material migrating between areas of different local light intensity, and becoming trapped within the crystal when the source of illumination is removed. The effect is typically temporary, and the trapped charge bleeds out after several months or years of storage in the dark.

Much research is currently under way to find materials with better persistence.

To produce a holographic memory device from a chunk of
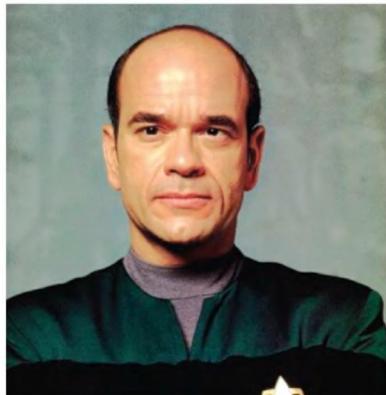
Barkley rocks. He's one of only two characters in the whole *Star Trek* canon who knows what to do with a holodeck. Sail ship simulations? Pfft. Twisted fantasies are what we're after. So who's the other character then? Why, the good Doctor of course. Even though he's a hologram, he somehow manages to have a more vivid imagination than the rest of the *Voyager* crew. Go figure.

such material requires that we illuminate it with a beam spatially modulated with a data pattern, and a reference beam. This produces an interference pattern within the bulk of the material, which is recorded. To read out the recorded data, it is necessary to illuminate the material with a readout beam which duplicates the reference beam, and use a device such as a CCD camera to detect the resulting light radiated from the device, which contains the same spatial brightness variations as the original modulation beam did. In this manner, the array of bits which modulated the brightness of the original modulation beam is replicated on the face of the CCD and may then be read out again. In practice a Spatial Light Modulator (SLM) might be built with an LCD light valve or a digital micro-mirror, which allows pixels to be turned on and off easily (see illustration).

This arrangement as it is would allow us to record only one array of data bits, which exploits but a small fraction of the capacity of the material. If we change the angle of the reference beam slightly, we can in turn record another array. In this fashion, termed 'angular multiplexing', it is possible to record hundreds to thousands of arrays of pixels or 'pages', forming a `stack' of holographic data pages.

To select a specific array of bits, we merely need to adjust the readout beam to the

ABOVE: Types of holographic media; this being solid state which promotes fast access speeds.

LEFT: Rotating disc media, which promotes availability.

BELOW: Hard drives in an archive, promoting redundancy.

'. . . it is possible to record hundreds to thousands of arrays of pixels . . . forming a `stack' of holographic data pages.'

technology is managing the effects of noise. Because the data bit array readout is very faint, the noise in the CCD detector elements can swamp the data. Even small misalignments in the optics can cause light to spill over from neighbouring bit cells, and scattered light within the optics will further degrade the detection thresholds.

The solution to these limitations is in principle no different from that used in established technology such as disk drives. A certain proportion of the total data bits recorded will be used for Forward Error Control (FEC), and are redundant to allow the recovery of the data with a very low error rate. Other tricks from established technology can also be used, such as spatially pre-coding the data array to avoid data patterns which exacerbate effects like inter-pixel interference, in a manner not unlike interference control techniques in datacomms. Differential encoding in holograms is a direct analog to the popular Manchester code used in LANs.

The aimpoint for raw Bit Error Rates (BER) in hardware at this stage is around 10^{-4} BER, which combined with suitable coding techniques can produce system level BERs of about 10^{-15}, which is competitive with established magnetic media.

A Holographic RAM (HRAM) based on this technology has its idiosyncrasies. One is that data can only be accessed and read out a page at a time. Typical per page readout times are dominated by the performance and size of the CCD detectors, but existing research indicates that a 1 millisecond readout time is practically achievable.

If we assume 1MB per page, ie. about 100KB with coding, and one thousand pages read out per second, this provides the HRAM with a read access bandwidth of about 1GB/s or 100MB/s, which is respectable performance by any measure.

Recording rates for HRAMs are much slower, typically 10 to 100 milliseconds per page, thus resulting in write bandwidths between 1 to 10MB/s, which is still competitive with magnetic disk technology.

An important limitation of HRAMs is that data can only be manipulated at the page level, and thus changing a byte as is done in solid state RAM is not practical. Difficulties have also been encountered with selective writing of pages in a 'stack' of hologram pages in the crystal. The approach followed mostly at this time is to treat the HRAM as a WORM (Write Once Read Many) device, write it once until full, use it for high speed data readout, and then repeatedly bulk erase it for reuse again. Another issue is recording lifetime, and subject to materials used, and the difficulty in selective page
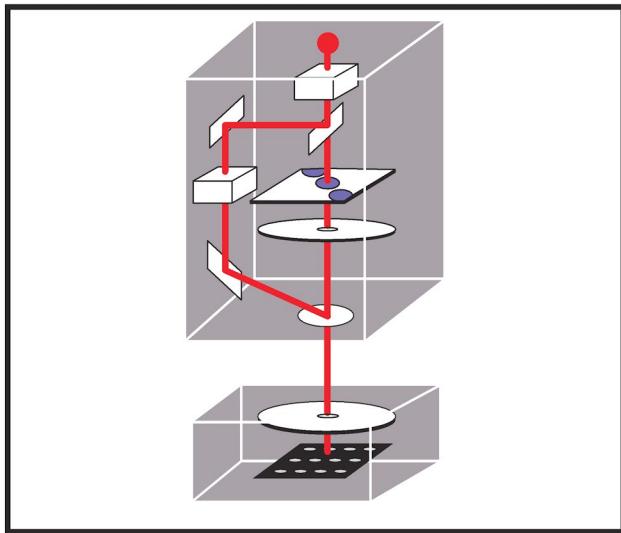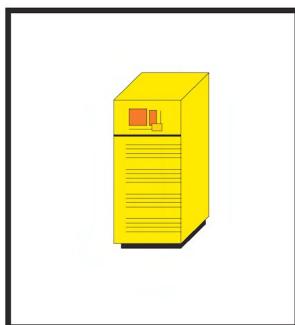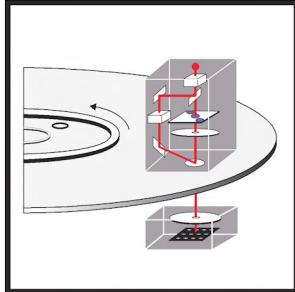
appropriate angle, and the indexed 'page' of data appears on the readout CCD, whence it can be converted into an electrical readout. This is of course easier said than done, since the angular changes required are extremely fine, of the order of 0.002 degrees of arc. Therefore selecting a specific 'page' of data can be a little tricky. The speed with which the readout beam angle can be adjusted sets limits on page addressing speeds.

A clever variation on the addressing mechanism is a scheme devised by Lucent Technology in the US. The Lucent scheme uses a fixed pair of beams, but rotates a circular slab of optical material to effect page addressing. Combined with recently developed photo-polymer materials Lucent claim a 125GB capacity on a 5.25in holographic disk.

Another important issue with bulk holographic memory

RAM! MY BUS IS LATE

Main memories in computer equipment have followed a similar Moore's Law curve to CPUs and GPUs, but have done so with density as the primary aim. Megabytes per dollar have ruled in the DRAM (Dynamic Random Access Memory) market and this reflects in highly competitive pricing to home and industry users. A key driving force for the DRAM market has been bloat in desktop application software and proprietary operating systems, and the popularity of GUIs and GUI-based applications has been central to bloat in most application areas.

While price per dollar has been the prime mover in the DRAM market, we have also seen useful gains in performance with the adoption of pipelined block addressing schemes such as DDR which permit higher average access times for burst memory read operations. While latency in transfers, the delay between the issuing of an address and the memory returning a result has not improved dramatically, the burst transfer modes have typically made a useful difference in feeding instruction stream hungry gigahertz-class CPUs.

refreshing, this is an area requiring further research.

The WORM-like characteristics of the HRAM suggest that its best near term application lies in areas where high bandwidth readout and infrequent writes are encountered, and Web, database or multimedia servers have been suggested as suitable applications. In a desktop environment it would offer a capability not unlike a DVD writer, only vastly larger and faster. For gamers this presents interesting possibilities as vast amounts of background scenery and animations can be stored and distributed. As a DVD replacement a single holographic disk could store a whole season of *Star Trek*.

A more mature fixed HRAM capable of fast and reliable random page addressing becomes a genuine competitor to the established magnetic hard disk – one which could potentially bypass the mechanical access time limitations of the hard disk. The main issue is steering the page addressing laser beam electronically – IBM claim potential addressing times as short as 10 microseconds or about 100 times faster than a hard disk.

While the HRAM is as yet not mature enough for production purposes, the technology is rapidly approaching this point.

In conclusion, new storage technologies such as non-volatile RAMs and holographic devices are set to dramatically change computing over the next two decades.

A teaser ram is a ram who *hasn't* the balls to do the job. Literally. Teaser rams aren't used to impregnate ewes; instead, teaser rams are, er, equipped with a 'marking harness' or brisket (chest) paint. The ram will then go around and 'mark' the rumps of those ewes that are in heat, so they can be fertilised artificially later on. A poor fate for those guys? Maybe, but who says they don't appreciate a brisk, early morning rump.

THE 'INSTANT ON' COMPUTER
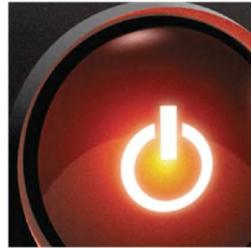
With a non-volatile or persistent main memory, be it populated with FRAM, Ovonic RAM or MagRAM, we are presented with some interesting possibilities.

With main memory as persistent as a hard disk, but as large and fast as today's DRAMs, we really don't need to go through the tedium of booting every time the computer is powered up. With an appropriate operating system design, a machine with a non-volatile or persistent main memory could be booted once, and unless the user desires otherwise, shut down and restarted with a completely intact memory image in situ. Such a restart would take at most milliseconds – in effect the machine would restart instantly in exactly the same state as it was previously stopped in.

Such a machine, presented with a power failure or a flat battery, could suspend itself once it senses a dropping power rail and thus recover almost instantly once power is restored.

Readers who might be intent on ripping the DRAM out of their existing machine and loading it up with MagRAM or FRAM beware – both hardware and operating system changes are needed to produce this type of capability.

The principal hardware change is that a power fail interrupt must incorporated – a feature of many designs which is more than often not used. Operating systems will require much more extensive surgery.

When a machine is booted, the operating system typically probes all of the hardware in the machine, either directly or via the BIOS, and then initialises the hardware to run it. Various registers in the CPU, motherboard chipset, motherboard I/O controllers, plug-in I/O boards (PCI, ISA, VME etc) have to be suitably written to get the hardware into the intended state. When power is removed from the machine, the state of these registers is wiped.

If the machine is supporting an 'instant on' capability, any situation which results in a power-down requires the interrupt service routine that handles a power-down not only tidy up the CPU and save its state information, but it must also read every single hardware register on the system to record and save its state into the non-volatile main memory. Otherwise on a restart most of the hardware in the system would be in an undefined state.

During an 'instant on' restart, the CPU coming out of its reset state has to load a special boot routine that finds the saved hardware state information for the whole system, and then reinitialises all of the hardware to its state before the power-down. Only after all of the hardware has been reinitialised can the CPU reload its last state information before the power down and restart the application or operating system routine last executed. Some peripherals may require several seconds to initialise and this could delay a restart – having said that, a five-second restart still beats a three-minute cold reboot!

While 'instant on' is clearly technically feasible, it is likely to require a lot of work on most existing operating systems which were designed and have matured running on volatile memory based hardware.
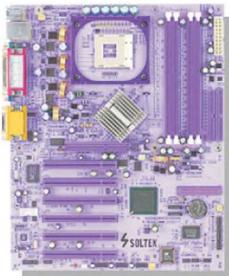
MITTONI

www.mittoni.com.au

Polished Metal Tables

Is your PC still sitting on a chipboard desk? Checkout our range of mirror-finish metal table designs

Spark 7 Cooler $44
Volcano 11 Cooler $49
Hardcano 9 4-Fan $59

Soltek AMD/Intel Motherboards

Violet and Gold Soltek motherboards. Hyper Threading Technology, DualDDR and great for high performance computing. 800FSB and more.

Thermaltake
COOL•ll YOUR LIFE

Xaser III 2000A **$363**   Xaser III 1000A **$286**

Fan forced DDR/SDRAM cooling kits **$22**

5-Port USB 2.0 PCI Card **$46**

Digital Storage and Readers

Tripper Photo Storage

From **$259**

Single Slot Card Readers **$29**

USB 2.0 6-in-1 Card Reader **$59**

Transfer up to 60GB directly from digital camera memory cards

Optical Mouse Readers for all cards

USB Flash Pen Drive
Transfer data in your pocket or your keychain!

apc EDITOR'S CHOICE DEC 2002

64MB	$55
128MB	$81
256MB	$154
512MB	$297

Rated #1 in December 2002 lab challenge due to "...its combination of fast transfer speeds, low price and great all-round feature set".

USB 2.0 Mobile Drive
The Perfect Mobile Transfer and Backup Solution

Enclosure	$48
20GB	$213
40GB	$279
60GB	$400

Backward Compatible
The Mobile Drive will function on any USB or USB 1.1 connection

PUMP UP THE POWER OF YOUR DIGITAL CAMERA WITH MITTONI HiSpeed FLASH MEMORY

As the **only** Australian member of the CompactFlash Association, our cards are **guaranteed** to be fully compatible with **any** device that accepts CompactFlash storage cards

Refund or exchange offered whatever your brand of camera or digital device for maximum piece of mind with your purchase

CompactFlash
32MB	$29
128MB	$66
256MB	$106
512MB	$195
1GB	$399

Secure Digital
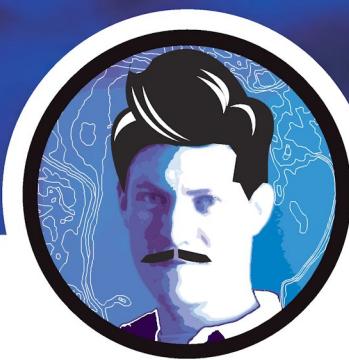|	
128MB	$105
256MB	$179
512MB	$499

...plus more!

402 Ferntree Gully Road
Notting Hill, Vic 3168
Telephone (03) 9560 6100

www.mittoni.com.au

REVIEWS

Unlimited, mobile, free memory – say what, where?

Your encephalon rocks according to in-house cybernetic organism, Nathan Davis.

Looking towards the future, technology is headed in such an oh-so-sweet direction, particularly the newly foreseen storage methods for our precious data. From holographic to photorefractive data storage, it's all happening in the magnificent world of digital athenaeums.

There is one problem with this sweet new tech, and that is the insane cost – both in R&D and when it hits the market. Heck, $21.6m has been invested in Heat Assisted Magnetic Recording. By the end of September 2006 the group 'Advanced Technology Program' hopes to have achieved the storage density of one terabit of data per square inch on magnetic media – using a thermally assisted recording method (very nice). The humble CD burner didn't escape the rich scale – when they first hit retail, you could purchase a more than half-decent car for the same price.

So instead of sucking our pockets clean on a storage technology which really isn't going to last us a particularly long time, how about using something we all have but have never really used in a techie type way. In fact, it's controlling the dribble I'm currently spilling right here. Yeah, our brain – why the dingers not? It's free and we all have one. . . so I am lead to believe.

Your medulla oblongata is the perfect place to store information – we already do it in an abstract way, it's just a matter of developing a technology that can use and create this data. Firstly, there would be no need for a power source, as our brain already has its own source. Secondly, it's fully mobile – it will always be with you, wherever you are. Finally, it has practically unlimited storage, which in itself is phenomenal.

It isn't impossible; it's just a matter of figuring out exactly how our brains commute data around and how to get it in there. There are many theories surrounding how our brain ticks over its bandwidth meter whether it's binary or some other twisted type of electrochemically stimulation. However it works, we just have to find out – the possibilities are far beyond astounding, they're unlimited.

So, perhaps research money could instead be better spent on more study specifically on how our brain stores and retrieves data? It's not a matter of if, but merely when we find this pattern. The sooner the better – once we finally have the tech of being able to shove information directly to our brains, we'd have so much more sick new technology to come up with.

Even communication – we would also be able to 'sub-talk' with each other – anywhere – via a wireless connection to our brain.

Not just a hidden internal type of communication, but a visual one with video and even sound. So whether you're 'sub-talking' or actually exercising your mouth, you can stream/send related multimedia files.

Learning would be just like in *The Matrix* – if you want to have new skills, like becoming a rocket scientist, simply plug in, pay a fee and download – congratulations you're now a wunderkind (depending on the data source's reliability).

This is seriously incredible stuff. The entire education system would be totally changed for good.

No need for schools anymore – just jack in and have your daily upload. Imagine; we'd have two-three year old kids running stock markets. . . which is freaking awesome!

Whatever cool inventions that'd come out of this, the way we look at computers would be completely altered – why have restrictive amounts of memory and bulky monitors when it's all neatly packaged in your head?

The only real problem I can see is if we start fiddling around with our brains, would there be any major side effects? Regardless, our brains are largely untapped mass storage devices that are capable of so much more than what we currently severely limit them to. Hey, what's with the white coats, fellas?

I guess I'd better introduce myself. Howdy ho, I'm Nathan Davis – the new guy. Many of you may well know me as my alter ego 'meatbites' on the great *Atomic* forums.

Well, it's awesome to be onboard – hope you enjoy the crazy ride. Catch you 'round. . .

http://skepdic.com/memory.html

Benchmarks

At *Atomic,* it is our primary intention to give you the final word on the latest in hardware and PC technology. An integral part of determining the performance of a particular piece of hardware is benchmarking, and this is something that we take very seriously in the *Atomic* Labs.

SYSmark2002

SYSmark2002 is a product of the collaboration between industry group BAPCo (www.bapco.com) and MadOnion.com (www.madonion.com). It is one of the next-generation application benchmarks and is designed to more accurately replicate the day-to-day workload that a system is subjected to. The focus of the benchmark is on Internet Content Creation and Office Productivity tasks, which combine to produce a final performance rating.

Unreal Tournament 2003

UT2K3 is the latest and greatest first person shooter from Epic. The game makes use of the new Unreal Warfare engine, and as such is a perfect benchmark for system performance. We use HardOCP's (www.hardocp.com) benchmarking utility to run a series of flyby benchmarks at varying resolutions to test performance. The utility also features support for a low resolution/high geometry CPU test. Results are in average frames per second.

3DMark2001SE Pro

3DMark2001SE Pro from MadOnion.com is the next progression of the popular benchmark utility. It also uses the MAX-FX engine and heavily emphasises DirectX 8.1 functions, including programmable shaders. The results are not comparable with results from 3DMark2000 Pro.

Serious Sam: SE

Serious Sam: The Second Encounter is used for testing OpenGL performance. For game tests we use the Cooperative demo, which outputs an average framerate trimmed of excessive peaks. It also contains a fillrate test, which outputs fillrates for various texturing methods and is useful for making comparisons between video chipsets.

HSF testing – Chernobyl

To test heatsink fans we use our custom engineered CPU replicator, known as Chernobyl. This beastie pumps a variable wattage through a solid Copper CPU die replica, with a temperature probe mounted in the exact centre of the die replica. Chernobyl results are not directly comparable with real world temperatures, but do provide a very accurate benchmark.

Quake 3: Arena *AtomicMPC* demo

Quake 3: Arena (Q3A), from id Software, is a very popular first person shooter, and represents widely used OpenGL gaming technology. Q3A has a built-in benchmarking utility and built-in demos that can test graphics card performance. These demos are fairly simplistic, so we developed our own *AtomicMPC* demo that pushes the hardware as far as possible.

Other benchmarks

Sometimes we need to break down the tests into more specific areas, such as hard disk performance, memory performance, or a particular facet of 3D, such as T&L. We can draw on a vast number of applications, games and dedicated benchmarks such as CD Speed 99, DisplayMate, Dronez, MDK2, or Adaptec ThreadMark to perform these tests. We also use a Lian Li temperature probe from Anyware (www.anyware.com.au) for tests that involve the measurement of temperatures, such as HDD heatsinks.

Atomic Hot Award

The *Atomic* HOT award is given only to the most kickarse products to hit the Labs, ones that score nine or greater.

ATOMIC TESTBENCH SPECS

Both test systems use Windows XP Professional with Service Pack 1, DirectX 8.1 and the latest chipset and video drivers.
- **AMD Athlon XP 1800+ system – ASUS A7V266-E motherboard (supplied by CASSA:** www.cassa.com.au**)**
- **Intel Pentium 4 2GHz – ABIT BD7II-RAID motherboard (supplied by ABIT:** www.abit.com.tw**)**

Common components
- **Corsair TwinX XMS3200 matched dual-channel DDR-RAM (supplied by Altech** www.altech.com.au**)**
- **Hercules Prophet II GTS 32MB (supplied by Guillemot:** http://au.hercules.com**)**
- **64MB Apacer memory keys (supplied by Anyware:** www.anyware.com.au**)**
- **Hercules Prophet II GTS 32MB (Supplied by Guillemot:** www.hercules.com**)**
- **Sound Blaster Live! Player (Supplied by Creative Labs Australia:** www.creaf.com**)**
- **ASUS 52x CD-ROM (supplied by CASSA)**
- **Belkin PCI FireWire card (supplied by Belkin:** www.belkin.com.au**)**
- **Belkin PCI USB 2.0 card (supplied by Belkin)**

BENCHMARK SETTINGS

3DMark2001SE Pro
- **1,024 x 768; 16-bit colour; 16-bit textures; 16-bit Z-buffer; triple frame buffer.**
- **1,024 x 768; 32-bit colour; 32-bit textures; 24-bit Z-buffer; triple frame buffer.**
- **1,600 x 1,200; 16-bit colour; 16-bit textures; 16-bit Z-buffer; triple frame buffer.**
- **1,600 x 1,200; 32-bit colour; 32-bit textures; 24-bit Z-buffer; triple frame buffer.**

Quake 3: Arena *AtomicMPC* Demo
All tests use Quake 3: Arena 1.27g and our custom Q3A demo recorded by the *Atomic* staff.
- **CPU testing: 320 x 240; maximum geometry detail; minimum graphics settings; high sound quality.**
- **Graphics cards: Low quality – 1,024 x 768; normal quality graphics settings; sound disabled.**
- **Medium – 1,280 x 1,024; maximum graphics settings; with all game sound disabled.**
- **High – 1,600 x 1,200; maximum graphics settings; with all game sound disabled.**

Framerate

It's probably the first time in months we haven't had an NVIDIA offering plastered across Framerate. It's like having your spleen removed – you can live without it, but it's still not right.

Sapphire RADEON 9800 PRO

SPECIFICATIONS: ATI RADEON 9800 PRO; 128MB 256-bit DDR RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 380MHz **MEMORY SPEED:** 680MHz **PRICE:** $771
WEBSITE: Sapphire www.sapphiretech.com
SUPPLIER: Achieva www.achieva.com.au

It is definitely not lonely at the top of the performance curve at the moment. The flood of RADEON 9800 PRO models is well and truly underway and companies such as Sapphire have entered the market with blinding speed. With 9800s blasting into the market, prices for 9700s and 9500s should come down. Get those wallets ready.

Powercolor RADEON 9800 PRO

SPECIFICATIONS: ATI RADEON 9800 PRO; 128MB 256-bit DDR RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 380MHz Memory speed: 680MHz **PRICE:** $695
WEBSITE: Powercolor www.powercolor.com.tw
SUPPLIER: Australia IT www.australiait.com.au

Powercolor are another company that revels in its alliance with ATI, and the RADEON 9800 PRO adds some top-end firepower to the line. With little performance difference between this and other models the choice comes down to price and looks.

Sapphire RADEON 9600 PRO

SPECIFICATIONS: ATI RADEON 9600 PRO; 128MB 128-bit DDR RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 400MHz **MEMORY SPEED:** 600MHz **PRICE:** $399
WEBSITE: Sapphire www.sapphiretech.com
SUPPLIER: Achieva www.achieva.com.au

Sapphire's contender for the mid-range crown is this RADEON 9600 PRO card. While it lags slightly behind Gigabyte's model, it still delivers reasonable performance for those looking to splurge a little and go for the best the mid-range has to offer.

Gigabyte RADEON 9600 PRO

SPECIFICATIONS: ATI RADEON 9600 PRO; 128MB 128-bit DDR RAM; dual 400MHz RAMDACs; TV-out.
CORE SPEED: 400MHz **MEMORY SPEED:** 600MHz **PRICE:** $519
WEBSITE: Gigabyte www.gigabyte.com.tw
SUPPLIER: Synnex www.synnex.com.au

In the shadows of NVIDIA's first 0.13-micron steps comes Gigabyte with its RADEON 9600 PRO. This chip marks ATI's first foray into 0.13 and it delivers decent mid-range performance with DX 9 features.
The price is a little on the heavy side though, enough that you might consider a 9700 instead.
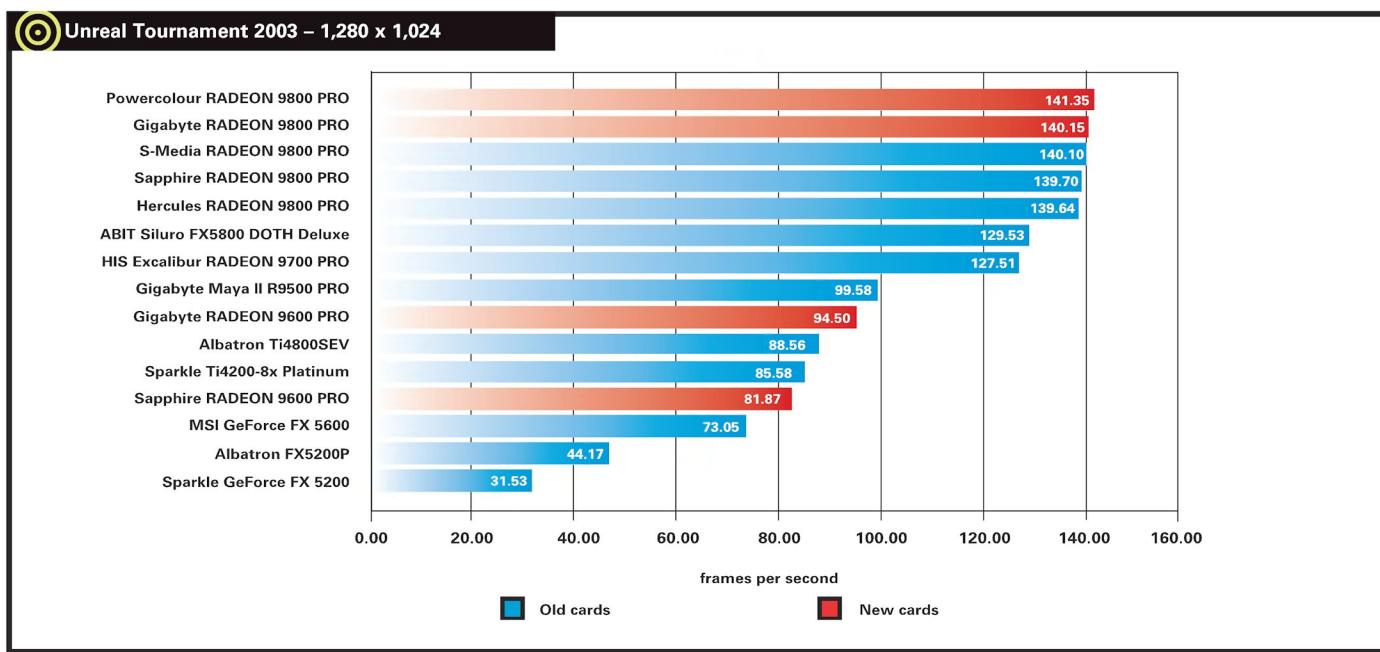
Video cards

Consolidation is the key for NVIDIA and ATI at the moment, as NVIDIA continues to introduce the GeForce FX 5900 series of cards and ATI solidifies its lineup with the RADEON 9600 and the 256MB DDR-II version of its RADEON 9800 PRO chip.

But the most exciting news in the industry is that small fish Xabre Graphics Inc, which was recently spun off from chipset maker SiS, has gobbled up the graphics division of fellow minnow, Trident.

For now, expect rebranding of existing products, but the really interesting things will happen six months to a year down the track. Maybe by combining both the companies' half-arsed attempts at modern GPUs there will finally be a third-arse added to the monkey that is the 3D graphics industry. At the very least, there will be a new company to compete with ATI and NVIDIA.

Unreal Tournament 2003 – 1,280 x 1,024

	fps
Powercolour RADEON 9800 PRO	141.35
Gigabyte RADEON 9800 PRO	140.15
S-Media RADEON 9800 PRO	140.10
Sapphire RADEON 9800 PRO	139.70
Hercules RADEON 9800 PRO	139.64
ABIT Siluro FX5800 DOTH Deluxe	129.53
HIS Excalibur RADEON 9700 PRO	127.51
Gigabyte Maya II R9500 PRO	99.58
Gigabyte RADEON 9600 PRO	94.50
Albatron Ti4800SEV	88.56
Sparkle Ti4200-8x Platinum	85.58
Sapphire RADEON 9600 PRO	81.87
MSI GeForce FX 5600	73.05
Albatron FX5200P	44.17
Sparkle GeForce FX 5200	31.53

frames per second

■ Old cards ■ New cards

CPUs

The drought of new desktop releases from Intel and AMD has now begun and we aren't expecting any significant movements on the CPU front until the 'still on for September' launch of the Athlon 64.
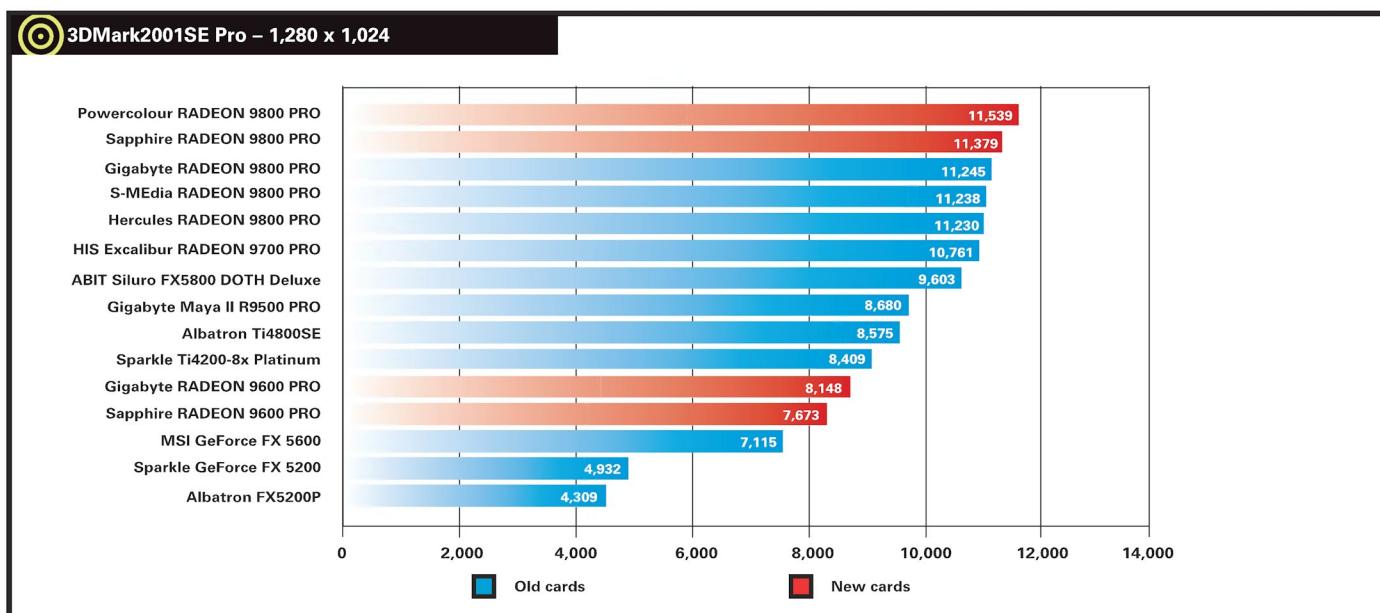
However there have been moves afoot with Intel's mobile products, with a consolidation happening between the Pentium-M line used as part of the Centrino marketing push and the existing Mobile Intel Pentium 4 Processor-M.

To avoid confusion Intel has changed the latter's name to the Mobile Intel Pentium 4 Processor.

This is aimed at the desktop replacement market and is essentially a Pentium 4 with Speed-Step technology and a much reduced heat output.

These new CPUs, available in speeds up to 3.06GHz, finally bring the 533MHz FSB to the mobile Pentium 4 and are accompanied by two new chipsets, the 852PM and GME. We should see notebooks in the coming weeks that make use of this extra speed.

3DMark2001SE Pro – 1,280 x 1,024

	score
Powercolour RADEON 9800 PRO	11,539
Sapphire RADEON 9800 PRO	11,379
Gigabyte RADEON 9800 PRO	11,245
S-MEdia RADEON 9800 PRO	11,238
Hercules RADEON 9800 PRO	11,230
HIS Excalibur RADEON 9700 PRO	10,761
ABIT Siluro FX5800 DOTH Deluxe	9,603
Gigabyte Maya II R9500 PRO	8,680
Albatron Ti4800SE	8,575
Sparkle Ti4200-8x Platinum	8,409
Gigabyte RADEON 9600 PRO	8,148
Sapphire RADEON 9600 PRO	7,673
MSI GeForce FX 5600	7,115
Sparkle GeForce FX 5200	4,932
Albatron FX5200P	4,309

■ Old cards ■ New cards

Toshiba Satellite 5220 <<<

John Gillooly discovers that for notebooks, blue is one screamin' colour.

With the hubbub around Intel's Centrino notebook marketing strategy and all of the associated hardware, the burgeoning desktop replacement market has sadly faded into the background.

Which is a shame, because while thin and light notebooks have enormous wanker value, performance freaks understand the need for a multi-gigahertz, big-screened, graphically laden, genital scorcher of a notebook.

This issue we have looked beyond the murky depths of the Centrino-hood and found that Toshiba's Satellite 5220 is such a laptop without the heat-based dangers to fatherhood.

It is packed with features enviable on a desktop system: a 2.4GHz Mobile Pentium 4 processor; 64MB GeForce FX 5600 Go graphics; 15in UXGA screen; Harmon Kardon 2.1 audio built-in and a DVD burner. It's certainly the most powerful laptop to enter the *Atomic* Labs.

And it is damn sexy too. In the world of notebook design nothing comes close to Toshiba's tough blue plastic clamshell with Audi TT influenced rear end. It is big, weighty and has enough blue glowy bits to soften the blow of moving away from the desktop.

Instead of a boring touchpad for mousing, Toshiba uses something it calls a cPad, which is a small monochrome LCD touchscreen with its own software, capable of running applications in its own right while also doubling as the touchpad. These include handy things like a calculator and calendar, making the cPad a useful device rather than the novelty one would expect it to be.
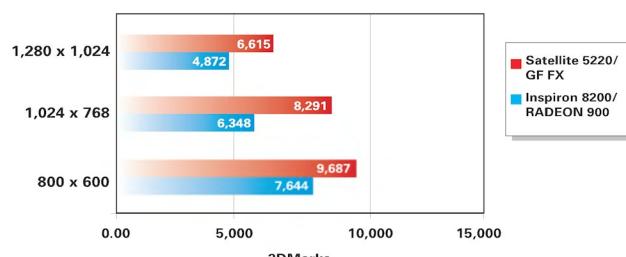
Another outstanding part of the design is the sound system. Usually notebook speakers sit squarely in the tinny and annoying basket, but Toshiba has continued its partnership with Harmon Kardon to design the speaker system for the 5220. This consists of two satellites built into the rear corners of the unit and a small subwoofer embedded in the base. While you will be unlikely to break any noise pollution laws with these speakers, they are remarkably crisp and clear and fine for gaming, DVD watching and listening to MP3s. And if they aren't enough, then you can always plug external speakers in.

The DVD burner in the 5220 supports DVD-RAM, DVD-R, DVD-RW, CD-R and CD-RW, which is a great achievement for a notebook PC, but falls behind the current trend towards desktop drives that support both the '+' and '–' DVD standards. Besides this there is also a 5,400rpm 60GB hard drive and an expansion bay that can take another hard drive, battery or optical drive.

But all the features in the world matter little if the notebook performs like an underclocked Sinclair ZX 81. Thankfully it's in the performance stakes that the Satellite 5220 leaves competing models for dead. This is thanks to the grunty, but by no means top end, 2.4GHz Mobile P4 CPU.

For gaming however, the real heart of the machine is

3DMark2001SE Pro

	Satellite 5220/GF FX	Inspiron 8200/RADEON 900
1,280 x 1,024	6,615	4,872
1,024 x 768	8,291	6,348
800 x 600	9,687	7,644

3DMarks

NVIDIA's GeForce FX 5600 Go chip.

We keep being blown away by the performance leaps that come with each new generation of laptop graphics, so we were eager to benchmark the sucker in pursuit of the holy grail of 10,000 3DMarks in 3DMark2001SE Pro. We compared the results with the last great notebook performer in the labs, the Dell Inspiron 8200, which used a 2GHz Pentium 4-M and a previous generation MOBILTY RADEON 9000 graphics chip.

Frankly, it is astonishing to see how far notebook performance has come in such a short amount of time. We first tested the Satellite with Unreal Tournament 2003 to see real world gaming performance and were quite pleased.

At 1,024 x 768 it averaged 63 frames per second, which is a very playable speed. This dropped to a passable average of 41 frames per second at 1,280 x 1,024 and a chuggy 25 frames at 1,600 x 1,200.

We then compared performance in 3DMark2001SE Pro with that of the Dell Inspiron 8200 and were suitably blown away. The 5220 was 25% faster than the Inspiron at 1,024x768 and 30% faster at 1,280x1,024.

Frankly, this is astonishing performance for a notebook. It's a shame that modern games like UT2003 are not playable at the native 1,600x1,200 resolution of the Satellite 5220's UXGA screen, but that's only a minor concern.

This is hands down the finest notebook for gamers we've seen, and the fact it's so incredibly laden with features is icing on the cake. The price tag is definitely daunting, but very reasonable for what you get.

Toshiba has again delivered the complete package with the Satellite 5220. With raw speed to burn, features galore and one of the best-looking cases out there, this is one of the most tempting luxury items on the market. **JG**

9.5/10

MSI MEGA651

Is it a hi-fi? Is it a PC? John Gillooly takes out the rubber gloves.

It is often funny to spectate on an emerging market, especially the mini-barebones craze that keeps gaining momentum. We have now seen the second wave of these suckers, and until now they looked like clones of Shuttle's excellent XPC.

Thank the gods of innovation that MSI has released its MEGA PC range. We've been eagerly awaiting this new unit since it was first announced, and with a tingle of delight realised MSI was going to do something different.

Forget the ambiguous multi-purpose positioning of previous barebones, the MEGA651 is purely about home theatre and comes with hardware and software that turns it into a highly capable beast.

This starts with the most obvious part of the unit, an LCD display with associated audio controls that makes it look like some trendy little micro hi-fi system. What isn't obvious from just looking at it is that these controls are almost completely self-sustained, working without need to start the PC. This unit is also remote-controlled and can pull audio data from the CD drive or use the inbuilt FM radio tuner. It even works when no PC components are installed in the box.

This is a fun addition, and one that's truly unique to MSI's product. It does not stop there though, as the PC itself is also highly targeted to home theatre use. Centred on MSI's new Media Centre II Deluxe software package, the MEGA651 uses the software to simplify the experience.

Music and videos can be accessed from user configurable directories, shortcuts can be set for games and applications and the whole interface is designed to be functional when viewed on a television. The only major shortcoming is that the remote control cannot be used for this menu, but it is something easily worked around by using a cordless mouse.

The functionality that MSI has packed into the MEGA651 is truly outstanding. Going the extra length to not only deliver a unique hardware product but to also provide all the software you need to squeeze maximum functionality out of the box deserves a major pat on the back, and we feel that in the next couple of iterations the MEGA PC will start to shine.

Building a system inside one of these boxes is always a fun experience to be had, and a great way to develop a feel for the design. MSI has a very different method of construction from many other makers, and some of their individual touches are really quite special.

The cooler is a great vented unit that shoves air through the case between two side exhausts, minimising the amount of ambient heat inside the MEGA651. The drive mounting mechanisms are also a joy to use, and there is space to add a second hard drive if needed.

It is the hardware itself that holds the MEGA651 back from greatness. Frankly, the old SiS651 chipset is not one of the best choices for delivering the perfect home theatre experience. For now that accolade rests with NVIDIA's nForce2 Athlon chipset. But we have fingers crossed and breath bated in the hope that ATI's RADEON 9100 IGP chipset will bring a similar level of multimedia goodness to the Pentium 4.

Some of the limitations are highly annoying, such as the fact that for TV-out support you need to obtain an AGP riser card. The introduction of an nForce2 model will alleviate this, as MSI should be able to integrate TV-out. When this happens the unit will easily fit into its niche. Of course, you could just add a separate video card, which would also move to solve the poor graphics situation.

That problem is that the integrated graphics in the SiS651 chipset blows ungulates. The graphics core in question is the SiS315, which delivers the same sort of graphical grunt as the GeForce2 MX. This is of course fine, if you want to go and make a coffee in between frames in UT2003, but for the sane, rational quadrant of humanity it is a non-event. At least the nForce2 is capable of decent performance, especially at television resolutions.

This is a product line that will definitely mature over the next few months. MSI has gotten past the first hurdle of nailing the MEGA PC concept and creating a mini barebones unit that distinguishes itself from the pack with added features. Once the internal hardware matures through new chipsets like the nForce2, i865G or RADEON 9100 IGP then the concept will meld together beautifully.

The good news is that the commitment is there from MSI and not only will we see more lines of MEGA PC, we will also see accesories – from the aforementioned TV-out bracket to a carry case for the unit. The software package is similar to that already available with MSI's TV Anywhere range of TV tuners and these products work beautifully together.

By building such an amazing piece of hardware around the crapulence that is the SiS651, MSI has fallen at the finish line. The MEGA PC is certainly destined for greatness, but just like Shuttle's early XPCs, there is still a way to go before everything clicks into place.

This is certainly an accomplished entry into this market, and one of the few that has impressed us with its innovative approach. The concept is impressively fantastic, and all MSI has to do is get the underlying hardware right and they will be onto a definate winner. **JG**

Specifications:

Mini-barebones case; SiS651 chipset; integrated SiS315 graphics; custom Media Centre software; LCD display; FM tuner; six-in-one card reader.

WEBSITE: MSI www.msi.com.tw
SUPPLIER: MSI www.msicomputer.com.au
PHONE: MSI (02) 9748 0070 **PRICE:** $699

7/10

Gigabyte RADEON 9800 PRO 256MB <<<

John Gillooly takes a ride with the limousine version of ATI's luxury card.

Codecreatures Benchmark Pro – quality settings

	RADEON 9800 Pro 256MB	RADEON 9800 Pro 128MB
1,600 x 1,200	13.7	7.9
1,280 x 1,024	18.1	12.7
1,024 x 768	24.2	23.7

frames per second

3DMark2001SE Pro – quality settings

	RADEON 9800 Pro 256MB	RADEON 9800 Pro 128MB
1,600 x 1,200	6,527	6,433
1,280 x 1,024	8,010	7,930
1,024 x 768	9,675	9,648

3DMarks

Unreal Tournament 2003 – quality settings

	RADEON 9800 Pro 256MB	RADEON 9800 Pro 128MB
1,600 x 1,200	56.64	42.89
1,280 x 1,024	77.17	68.92
1,024 x 768	107.07	105.55

frames per second

It's 'rulers out' time for ATI and NVIDIA in the latest round of 'Mine's bigger'. NVIDIA easily won last time with its cybernetically-enhanced chunk of copper with PCB inside called the GeForce FX 5800 Ultra. But it is now ATI's turn, in the form of Gigabyte's 256MB variant of the humble RADEON 9800 PRO.

Rather than channelling a year's worth of Chilean copper exports into the heatsink, or clandestinely steal fan designs from NASA's Jet Propulsion Laboratory, with this card Gigabyte has gone for understated. It looks like a normal 9800 PRO stretched slightly to fit more RAM chips, with little rows of RAMsinks designed to stop 256MB of textures from overheating. With the same core clock as the stock 9800 PRO, the memory runs 20MHz faster than the 128MB version.

There is an almost standard argument surrounding jumps in texture memory, namely that it's a pure marketing ploy with little real world impact. It satisfies the 'Mine's bigger' argument but translates to zero performance gain. We already know the 9800 PRO core has bandwidth to burn, so slightly higher RAM speed probably won't impact frame rate, the advantages of this card fall squarely in the 'twice as much memory' realm.

On-card memory is predominantly required for texture storage, and your average game barely stresses a 64MB model under normal circumstances. However, there are two reasons why more texture memory will come into play. As texture sizes increase, so does the amount of memory needed to store them. With games soon to use 2,048 x 2,048 textures the storage space needed is increasing – a minor factor in the equation.

The 9800 PRO packs phenomenal memory bandwidth. Under normal conditions this wouldn't be stressed, coming into play only when heavy levels of antialiasing and/or anisotropic filtering are used. However when these techniques *are* used memory use skyrockets as all sorts of extraneous texture information is stored.

To test this we took Gigabytes 256MB card and compared it to its 128MB baby brother. Both cards were identical apart from memory, which runs at 700MHz on the 256MB card and 680MHz on the 128MB version. We used 3DMark2001SE Pro, UT2003 and the texture memory intensive Codecreatures.

Our first run at standard speeds had both cards delivering almost identical results. So we reran the cards with ATI's quality slider in the control panel set to maximum, which turns on 4x antialiasing and 16x anisotropic filtering.

This second round of testing shows an interesting pattern that confirms our initial suspicions. At 1,024 x 768 there's no discernable difference between performance, a pattern that continues at all resolutions in 3DMark2001SE Pro. However in the more resource hungry UT2003 and Codecreatures tests the 256MB card pulls ahead in high resolutions. This is quite a
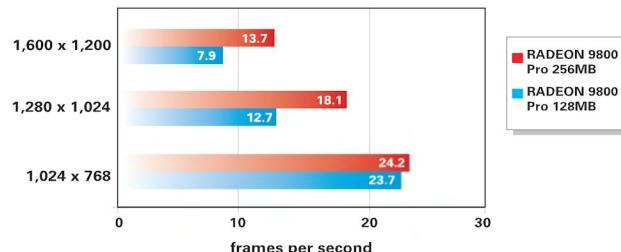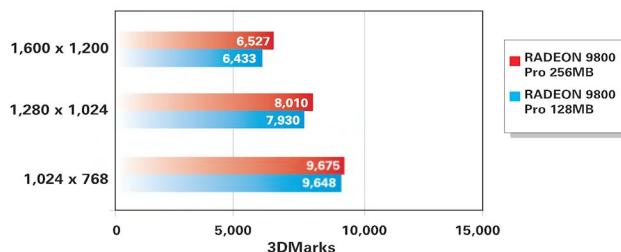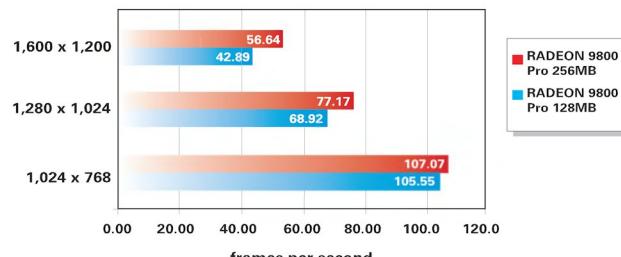
discernable difference, especially at 1,600 x 1,200 and drags the frame rate of UT2003 from the wrong side of acceptable to the realm of playable. Thanks to AA and AF it looks damn sexy as well.

This high-end performance boost makes Gigabyte's 256MB 9800 PRO the ultimate in frame whore accessories. If you want high-res and you want it damn beautiful then look no further than this baby.

JG

Specifications:

ATI RADEON 9800 PRO; 256MB DDR RAM; Molex power connector; dual 400MHz RAMDACs; TV-out.
WEBSITE: Gigabyte www.giga-byte.com
SUPPLIER: Synnex www.synnex.com.au
PHONE: Synnex 1300 880 038
PRICE: $TBA

9/10

Accent HT100G <<<

After an almost wholesale abandoning of the desktop form factor over the past few years it's strange that it has now returned, with slight tweakage and a new role. This new generation of desktop-shaped units is tailored for home theatre PC use, and the models vary greatly in functionality and size.

One of the bigger units is Accent's HT100G home theatre PC case. Available in black, Aluminium or anodised Gold, this case has been designed from the ground up to integrate into a home theatre setup. For example, the gold model that we looked at had the same sort of chunky dimensions and timeless lustre as a hefty old Marantz amplifier.

Unlike other cases of this type we've seen, the HT100G can accept a full-sized ATX motherboard. This is becoming less of a problem now that decent Micro ATX boards are on the market; however, it is the perfect size if you want to recycle your old desktop parts into a home theatre PC unit. It also accepts a full-sized PSU.

The outstanding aspect of the HT100G is the front panel. Made from an 8mm-thick chunk of Aluminium, this panel is designed to match most hi-fi parts. There are power and reset buttons, a flap that hides your optical drive, USB, IEEE 1394, a remote control and a VFD (Vacuum Fluorescent Display) readout that mounts in the front.

While the unit doesn't ship with software or instructions for the display, it works like any other LCD/VFD you can hook-up to your PC. It actually interfaces via the serial port and can be programmed with software downloadable through AusPC Market's Website.

This is an awesome unit for building a home theatre PC in. It is well built, roomy and packed with features. The DIY aspect of the remote control and VFD display is a great bonus, providing hours of tinkering and a huge degree of control over your new home theatre box. The only thing keeping this case from greatness is the price – a little to high for our tastes. **JG**

Specifications:

ATX-sized desktop style case; VFD display; IR remote control; two USB and one IEEE 1394 port (front).
WEBSITE: AusPC Market www.auspcmarket.com.au
SUPPLIER: AusPC Market www.auspcmarket.com.au
PHONE: AusPC Market (02) 9746 0900
PRICE: $518

8.5/10

Albatron FX5600EQ

With 256MB of RAM, John Gillooly finds a heavy Albatron hanging round his neck.

These are the moments we will tell our grandchildren about. The first '3D accelerators' had a whopping 4MB of memory. This doubled to eight, jumped for a short while to 12, then 16, 32 and then 64.

Today, the de facto standard is 128MB of texture memory. Now the shift is towards 256MB of memory for the premium end of the card market, with the RADEON 9800 PRO and GeForce FX 5900 Ultra appearing with 256MB onboard.

We recommend you first of all, read our Gigabyte RADEON 9800 PRO with 256MB RAM review. which you can find on *page 60,* for the reasons behind the move to the 256MB.

Albatron has brought this memory size into the mid-range with its FX5600EQ card. The FX5600EQ differs from others on the market by having 256MB onboard. To accommodate the additional RAM, the board has a reduced memory speed, which in turn is compensated by a boost in core speed, similar to the 128MB variants of the GeForce4 Ti4200. The theory behind this is that slower RAM is more affordable to board makers, reducing the price gap between the two different products.

The core of the FX5600EQ runs at 325MHz and the memory at 400MHz. In comparison the 128MB version has a core speed of 270MHz but a memory speed of 550MHz, with the faster memory having the greater influence.

We tested the card using Unreal Tournament 2003, Codecreatures and 3DMark2001SE Pro. We have decided to show the results for testing with default settings because the gap between the core speeds of the cards is much larger than the minor variations when using high quality, high resolution settings.

We compared the card to an MSI GeForce FX 5600 with 128MB of memory.

To have 256MB of video RAM is a luxury, no matter what angle you approach it from. At some point in the future games will catch up and start leveraging this memory size, but as our testing of Gigabyte's RADEON 9800 PRO showed (*page 60*), it only comes into play in extreme situations.

When we take the importance of the memory size out of the equation, we end up with a simple picture. The Albatron FX5600EQ is slower than a standard GeForce FX 5600 card, and this shows in the performance stakes.

We are all for exotically over-specced video cards – they satisfy the deep urge to have the most Copper-laden, chip heavy, heat-pumping card possible on the market. We just wish that the manufacturers didn't have to make it a trade

Codecreatures Benchmark Pro – quality settings
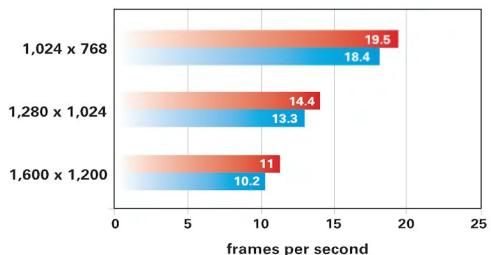
3DMark2001SE Pro – quality settings
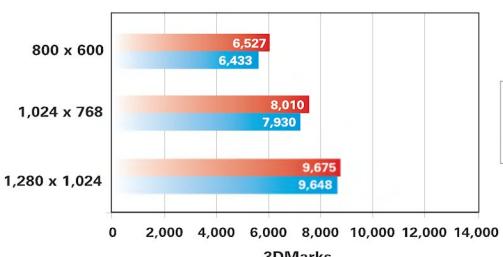
Unreal Tournament 2003 – quality settings
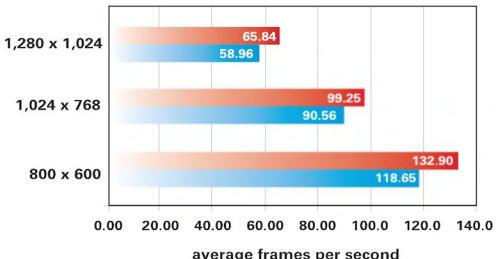
off. Give me 256MB of video RAM, but make it faster, with big spiky RAMsinks and a chunky Copper PCI-obscuring heatsink. That is doing the luxury item idea justice.

Albatron's FX5600EQ is a good, well made video card. It just lacks any advantage over the standard model. Unless you have some obscure or special use for 256MB of memory then go for the 128MB version. It's faster. **JG**

Specifications:

NVIDIA GeForce FX 5600; 256MB DDR RAM; TV-out; 325MHz core; 400MHz memory.
WEBSITE: Albatron www.albatron.com.tw
SUPPLIER: AMI computers www.ami-computers.com.au
PHONE: (07) 3808 9255
PRICE: $TBA

5/10

Jazz JS9938 5.1 speaker system

The Jazz JS9938 comes in an 'A' and 'B' series. We've looked at the A series and the only difference is the external appearance.

This 5.1 system is marketed as a 'private home theatre'. It features a separate control unit that decodes DTS, Dolby Digital (AC3), Pro Logic II and, of course, vanilla stereo. It supports two digital and one analog input. The system is operated either directly via the control unit, or by using the supplied remote. The remote also provides extended functionality with options such as 'c_delay', 's_delay' and preset effects such as 'theatre' 'hall' and 'stadium' environments.

Installation was straightforward, assisted by colour-coded plugs. The satellites can be wall mounted with the supplied brackets. Power for the control unit is drawn from a second cable to the subwoofer.

We tested on a Sound Blaster Audigy with a combination of MP3s encoded at 128KB/s, a few rounds of Raven Shield, finished off with *Star Wars: Episode II* on DVD, giving the system a full opportunity to strut its stuff.

These speakers aren't designed to be the excessively loud. The 5.25in subwoofer and 2.5in satellites pump out a total 45W RMS. Sound reproduction was generally impressive and surround sound was delivered accurately and effectively.

The high tones are clear, the mid tones are smooth and warm. The bass is rich and responsive until you crank up the volume on some bass-heavy sounds, then it becomes noticeably muddy and distorted. This is evident regardless of the sound source, without any real equaliser controls on-board, it left us just a little disappointed.

In terms of sound quality, these are quite capable at most levels. Overall, the sound experience is cinema like, full and immersive, with every sound detail sharp and clear, at average volumes. This is not the best we have seen from Jazz, however, and price will play a part in the success of this system. **SP**

Specifications:

45W RMS; impedance: 4ohms; frequency response: 60Hz~20kHz.
SUPPLIER: Sato Technology
PHONE: (03) 9899 6333
WEBSITE: www.satotech.com.au
PRICE: $380

6/10

VideoLogic ZXR-750 7.1 speaker system

The ZXR-750 is the latest from VideoLogic's range of surround speaker systems. This isn't a significant upgrade from the ZXR-500 and ZXR-550 systems – after all they contain almost identical components and basic circuitry. But it is a 7.1 system. That's seven satellites – count them, seven! Of course, to get the best from that level of surrounded-ness you will need a cutting-edge sound card that fully supports 7.1 sound. No matter, we made do with a Fortissimo 6.1; the closest we could get our hands on. The speakers do incorporate the technologies, ConnX.1 and SurFE, which allows any 5.1 sound source to be properly delivered to 7.1 channels. No need to chuck out your ageing Audigy just yet.

Setup was non-complicated, despite the ensuing tangled mess. An optional set of floor stands is available, although two sets of wall mounting brackets are included.

Once again, and as expected, the VideoLogic speakers shone, despite all we threw at them. Testing everything from Mozart to Metallica, hard gaming action and intense DVD audio, these speakers didn't let us down.

The bass, once tweaked, was rich, rumbling and responsive. Mid to upper tones were suitably smooth and clear at all but the highest volumes.

Due to the dual ports, position of the subwoofer is critical. Despite best practice of sticking your sub in a corner, this one needs to sit out a little. We found that the port on the side needed some decent breathing space, or the bass sounded a little strange.

Also, we discovered that pumping all your dials to '11' is not in your hearing's best interests and isn't recommended, unless that's your thing. A little knob twiddling never hurt anyone, so spend some time getting your bass and treble levels to a position best suited to the type of audio you are listening to. And this is probably the only draw back of this system. Those controls are located on the sub woofer, which often ends up becoming a foot rest under a desk. With more systems supplying separate control units and remotes, we hope VideoLogic sees the light and makes these standard features for future speaker systems. **SP**

Specifications:

84W RMS; frequency response: 18Hz~22kHz; input sensitivity: 400mV.
SUPPLIER: Syslink
PHONE: 1800 067 722
WEBSITE: www.puredigitalau.com.au
PRICE: $379

9/10

ELEVATE
TO PRO LEVEL

POWERED BY™
ATi
RADEON
9800 PRO

Sapphire Radeon 9800 Atlantis Pro
g r a p h i c   c a r d

SAPPHIRE

Load up your PC with amazing visual clarity and speedy framerates using ATI's latest Radeon 9800 Pro graphics chip. At Pro levels you will take control of alternate worlds with realism never seen before in games and multimedia applications. Experience the next level in professional gaming!

>>>>>>>>>>>

FEATURES:
256MB or 128MB DDR memory / 2nd Generation 8-pipeline graphics rendering technology / 128-bit floating-point for amazing colour range and accuracy / SMARTSHADER 2.1 for smoother 3D / SMOOTHVISION 2.1 for smoother texture / VIDEOSHADER for faster video processing / FULLSTREAM for clearer video streaming / DirectX® 9.0 and OpenGL 2.0 acceleration / 2.0 GB/sec transfer with AGP 8X / Sapphire Quality & Reliability

PROUDLY DISTRIBUTED BY

ACHIEVA
GROUP OF COMPANIES

(i) **www.achieva.com.au**

SYDNEY TEL (02) 9742 3288 • **BRISBANE** TEL (07) 3857 5969
MELBOURNE TEL (03) 9561 9899 • **PERTH** TEL (08) 9204 2388

KISS DVD Player DP-450

Thanks to the boom in broadband there's been an equally huge explosion in the amount of sharing of home movies on the Net. So much so most people have a few gigs of memory devoted to such collections.

Most of these have been encoded in DivX or the newer ghetto XviD codecs, making them perfect for watching on a PC, but fairly useless if you want to watch them on a normal DVD player.

Enter KISS and its Linux-based DP-450 DVD player. It looks like a DVD player, acts like a DVD player, but is really something special. It supports playback of movies encoded in DivX 4, 5 and XviD as well as MP3 audio. It's a terrific concept, and one that can constantly evolve through a simple process of firmware updating using ISO CD images downloadable from KISS' Website.

To watch DivX movies you need to burn them onto a CD or DVD. The unit can read DVD-R and DVD-RW but lacks support for the competing +R and +RW standards. Most movies will fit on a CD but for that high quality footage of Uncle Neo's holiday you'll need larger storage.

This is the main problem with this unit. KISS however has a newer player on the way, the DP-500, which adds an Ethernet connector and PC-Link software. It'll be an infinite improvement for those who have a large collection of visuals on their PC.

There are no complaints about image or audio quality. DivX looks nice and crisp on the TV screen and it is nice to not be tied to the PC all the time. The unit is also region-coded, but a few minutes with Google will be all that's needed to exert your right to choose what DVDs you watch.

For all the technological wizardry and functionality this unit has, it ends up being hampered by the need to burn everything onto discs. KISS has delivered a nice product but it is worth holding out for the DP-500. **JG**

Specifications:

Standalone DVD player; DivX 4, 5 and XviD support; downloadable firmware updates; reads CDDA, CDR, CDRW, DVD-R and DVD-RW discs.
WEBSITE: KISS technology www.kiss-technology.com
SUPPLIER: Lightspeed Distribution www.lsd.net.au
PHONE: Lightspeed Distribution (07) 3350 5800
PRICE: $645

7/10

Mambo X P353SD

You can pick up a 64MB MP3 player for fairly cheap these days. You can then downsample your MP3s so you can fit more than a mere handful onto the player and happily listen to the alright, but hardly groove-shattering tunes.

However, if you want an MP3 player that will store your *entire* MP3 collection then the only option is to buy a hard drive-based unit.

The Mambo X P353SD is such a unit. With 20GB and 30GB models available, it functions not only as an MP3 player but also as a portable USB 2.0 hard drive, digital voice recorder and SD and MMC card reader. It plays MP3 and WMA audio files and supports variable bit-rate MP3s.

Rather than use some sort of unwieldy and low functioned audio software to get music on and off the player, you simply copy the files over the USB 2.0 cable to the hard drive and then use the controls and backlit EL display to surf through the directories to the files you want to listen to. It also supports user-created playlists.

The unit is incredibly easy to use and the sound quality is solid, while it is competitive with other units on the market it's not quite at iPod level.

We were particularly impressed by the digital voice recorder function; after you've tried to discern meaning from hissy audiotape, 160KB/s MP3 voice is a thing of beauty. And with so much storage space available there is capacity for around 1,000 hours of lower quality voice recording on the 30GB model.

Unfortunately the unit is quite bulky when compared to the sleek models coming from Apple and Creative. It doesn't weigh much, but the chunkiness is annoying.

If you're looking for the specific range of functionality delivered by the Mambo X P353SD then it is a gift from heaven. If on the other hand you're just after an MP3 player with a hard drive, then the slightly more expensive iPod from Apple is still the compelling choice. However, the P353SD is one of the better MP3 players that we've seen, but for $799 it needs to be. **JG**

Specifications:

Specifications: 30GB HDD-based MP3 player; digital voice recording; SD and MMC card readers; backlit display; MP3, MP3 VBR, WMA and WAV support.
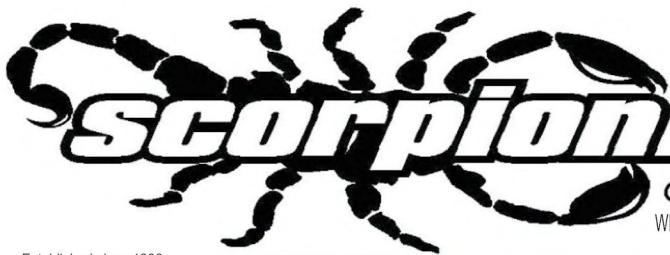**WEBSITE:** Mambo X www.mambox.com
SUPPLIER: EFX www.efx.com.au
PHONE: EFX (02) 9742 1900 **PRICE:** $799

8/10

Polyview CMV 1515 TFT <<<

You know, some dreams are so breathtakingly amazing you just don't want to wake up. When you do, you'll need to take a minute to recover. This baby was cause enough to sit me in the nearest seat with such force I now have a window in my bedroom floor.

Generally, TFT monitors have been renowned to be disgustingly expensive flat items that display a nasty blur, most of which also have low colour depth and are ridiculously overpriced. Serious blurring at an astonishingly steep 25ms response time, the majority of these displays don't allow any decent gaming. These God-forbidden things are simply not possible to game on, let alone practical.

This is quite a conundrum, as they look so damn sweet and being the small size they are, they'll practically fit anywhere. Carting these around to LANs is also a lot easier than lugging around a 20kg+ bulky box.

Well this awesome screen is anything but the above, bringing a huge breath of fresh air to the TFT market. It's a beautiful 15in screen, which is of course, the display size of a standard 17in CRT monitor. With a response time of a tiny 15ms, even fast-paced first person shooter games are fully playable on this – we tested it's fraggability with both Quake 3: Arena and Unreal Tournament 2003. There was a slight hint of blurring, but this is to be expected from any TFT screen and was hardly distracting.

Not only sporting a ratio of 500:1 in contrast, it also has an extremely good colour depth, with specific testing done in DisplayMate to confirm this. Its maximum and native resolution is 1,024 x 768, which is plenty of space for a 15in TFT.

Being so astonishingly cheap, at under $500 it's unbelievable to actually get *more* than what you pay for. Major kudos to Polyview for creating this absolute stunner of a piece of hardware for a fraction of its competitor's cost. Simply brilliant.

Performing at a consistently high rate its more expensive rivals cringe at, this monitor totally rocks. **ND**

Specifications:

15in TFT; 500:1 contrast ratio; 400cd/m2 brightness; 1,024 x 768 max native res; 15ms response time; D-sub; speakers.
WEBSITE: Impact Systems www.impactsystems.com.au
SUPPLIER: Impact Systems www.impactsystems.com.au
PHONE: (02) 9621 2999
PRICE: $499

9.5/10

Airstyle W-Shock 2 <<<

Cable tangles have been the bane of console existence since Shigeru Myamoto first crawled from the primordial soup and decided a crazed keg-tossing ape and stereotypical Italian plumber would craft video game history. It perhaps peaked when Microsoft had to build quick break mechanisms into its cabling in order to stop people from dieing when a carelessly tripped-on cord sent shards of spinney hard disk flying through the case of an Xbox and in to the room beyond.

So one wonders why a product like Fountech's Airstyle controller for the PS2 has not been done before. Sure there have been wireless controllers from many different sources, but they usually involve proprietary designs and never quite match up to the finely-honed perfection of Sony's Dual Shock 2 controller.

Fountech acknowledged this and it's created a stylish unit that looks and feels like a Dual Shock 2 controller. It is slightly more bulky and a bit heavier than Sony's unit but the button placement is identical and the feel is the same. Unlike Nintendo's Wireless Wavebird controller, the Airstyle even has rumbling built in, which can be toggled on or off.

The key to this unit's brilliance is that it doesn't try and reinvent the wheel; all it does is remove the cabling. Thanks to 900MHz RF operation, it avoids the need for line of sight managing to update fast enough to keep gameplay smooth.

It uses two AA batteries that usually last for a week or so of gaming – a set of rechargeable batteries is highly recommended. The rather rapid rate of battery chewage is somewhat due to the rumble function built into the control pad, but this is easily disabled.

Slick, stylish and very functional, kudos goes to Fountech for delivering a damn fine wireless gaming controller without trying to do something fantastical. With traditional Dual Shock design and nary a cable in sight this unit is a must have for serious PS2 gamers and unlike some units, is less than $100. **JG**

Specifications:

900MHz wireless PlayStation2 controller; Dual Shock 2 compatible; two AA batteries; economy mode.
WEBSITE: Fountech www.fountech.com
SUPPLIER: Impulse Gamer www.impulsegamer.com
PHONE: N/A
PRICE: $89.95

9.5/10

Albatron KM18G Pro <<<

Over the past year a quiet revolution has been going on in the world of motherboards. The Micro ATX form factor has always been tainted by the inevitability that it would be an all-in-one solution delivering average but stable performance for business use. Now, thanks in a large part to NVIDIA's nForce2 chipset, there are Micro ATX boards that rival their big brothers in terms of performance and features.

Besides boring business use, the biggest potential market for Micro ATX is home theatre.

We've already seen numerous home theatre PC cases that only support Micro ATX motherboards and until now we've been unable to find such a board that includes TV-out.

Albatron has also seen the gap in the market and as such is one of the first manufacturers to leap in with TV-out support via a blanking plate for its KM18G Pro board. By taking this one, admittedly small, step Albatron has turned a decent mobo into a great one for home theatre use.

Our testing of this board was not focused on performance; BIOSes for Micro ATX boards almost invariably lack the advanced tweaking features seen in full-sized ATX mobos. The board still keeps pace with its bigger brothers, but we focused on features and functionality.

And it surely does rock. The nForce2 chipset delivers all the capabilities you need to get a decent home theatre PC up and running, with quality video and audio. It provides a solid foundation and unlike Mini ITX boards and barebones units, it has three PCI slots, enough space for TV-tuner cards and other home theatre essentials.

Congratulations to Albatron for looking at this segment of the market and adding the functionality that was sorely lacking. If you want a cheap, powerful board to build a home theatre box then the KM18G Pro is one of the best motherboards available. **JG**

Specifications:

NVIDIA nForce2 IGP; onboard GeForce4 MX graphics; TV-out; USB 2.0; dual-channel DDR333 or DDR400 when using discreet graphics.
WEBSITE: Albatron www.albatron.com
SUPPLIER: AMI computers www.ami-computers.com
PHONE: (07) 3808 9255
PRICE: TBA

9/10

DFI LANPARTY KT400A

DFI has come a long way in a relatively short period of time. It has always been known for making decent, yet poorly featured, budget motherboards. This all started changing last year when it released its range of enthusiast boards, starting with the KT333 board.

This telegraphed a major shift in attitude for DFI, but unfortunately the start faltered when the person spearheading this enthusiast move, Scott, returned to work at ABIT.

It has taken a little while, but the second volley in DFI's enthusiast push has now been fired with the release of its LANPARTY motherboards.

These boards combine the features wanted by enthusiasts with a variety of paraphernalia that will come in damn handy for those who like to lug their PC around.

We dragged the KT400A-based LANPARTY board into the Labs, and after giving it a run to make sure there were no performance issues, we dimmed the lights and fired up our UV lighting.

All romance aside, we did this because on the LANPARTY boards all the PCI, AGP and RAM slots are imbued with UV reactant glowy goodness. So strap a UV light into your case and watch others gawp in amazement.

It's a fun little novelty that will appeal to some – but not all people. Thankfully there is more to the package than colourful slots.

The board also comes with a strap that can be used as a backpack for carting your PC around, as well as matching UV reactant rounded IDE cables and a front panel with USB, IEEE 1394 and audio ports.

With a decent motherboard at the heart of the package (even if it is not up to the level of nForce2) and some added extras that people will actually find useful, DFI has showed that it is serious about enthusiasts.

There is an nForce2 variant coming that will bring with it cutting edge performance, but for now this is a great package at a very reasonable price. **JG**

Specifications:

VIA KT400A chipset; RAID 1.5; USB 2.0; IEEE 1394; dual onboard Ethernet ports; carrying strap; front panel; rounded IDE cables.
WEBSITE: DFI www.dfi.com.tw
SUPPLIER: Game Vision www.gamevision.com.au
PHONE: Game Vision (02) 93450033
PRICE: $290

8/10

ATOMIC

artomic
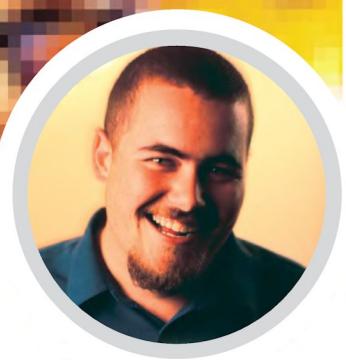
Tarnishing the silver screen

Movies and games, is there a more hellish combination? John Gillooly looks at the state of movie licences.

There is always an expectation of low quality when a game is sold around a movie license. Years of cashing in on unsuspecting gamers by putting a movie still on the cover and renaming a few characters in an almost complete game has lead to a disheartened community whose excitement level usually plummets when a movie tie in is announced.

It hasn't been all doom and gloom though. In the past the key to a successful, memorable movie tie in has been a focus on the game first of all, with the movie license influencing the design, rather than the movie concepts being retrofitted later.

One of the most seminal movie tie-ins was Bethesda Softworks' Terminator series. Rather than replicate the plot of the first two movies, Bethesda used the license to flesh out the universe in which the movies were set. Players were cast as a member of the resistance fighting against the Terminator army of Skynet.

Not only did these games increase quality and complexity, they introduced a fundamental gaming concept – mouselook. Terminator: Future Shock was the first to force gamers into the then tricky combo of mouse and keyboard.

Perhaps second on the list of quality PC movie tie-ins is Westwood's Blade Runner. Made years after Ridley Scott's movie, the game places the player on a replicant hunt, playing through similar scenarios yet avoiding links to the movie. Still a highlight of the dying years of the adventure game genre, its non-linear nature continues to be landmarks in game design.

Perhaps the most scattergun of movie franchises though has been Star Wars. It started well for LucasArts with Rescue on Fractalus in 1984, and then seven years later it continued with Star Wars for the NES, with a steady stream of games peaking with classics like Dark Forces and X-wing vs. Tie Fighter. These two big hits again fleshed out the universe.

Last year LucasArts released eight games, all based on Star Wars. Of these the only partially memorable one was Jedi Knight II. License milking like this has become commonplace in the industry and it's only going to get worse. In fact since 1999 LucasArts has only released three out of 28 games that weren't tied in to Star Wars. And two of those games were based on Indiana Jones.

Movie tie-ins are big business, tapping the mainstream games market as seen with the phenomenal sales of Enter The Matrix. But in the end ETM suffered a curious fate. Although it didn't retell the movie, the story was strictly controlled by the Wachowski brothers and lacked a special something.

This won't be the last of the licenses including hefty movie content. Tied in with the release this year of *Terminator 3: Rise of the Machines* is a game in which you get to play as Arnie himself. It looks, at the moment, to be a solid FPS, with very little in the early code to recall the magic of Terminator: Future Shock. It looks like a robust shooter, and finally playing Arnie will be fun, but revolutionary gameplay it ain't.

EA's Lord of the Rings: The Two Towers is looking like a major improvement on the last game, with the battle of Helms Deep being shown at E3 this year. Thrown into the middle of the battle, this is much more atmospheric than the original but still seems to lack that special something that makes a game great.

The Matrix Online also has potential, but it is still a long way away and details have to be kept to a minimum as it is based after the final part in the movie trilogy, *Matrix Revolutions*. The game has potential but faces severe technical challenges, like working bullet time in a multiplayer environment. If they manage to achieve this then we could well be looking at a landmark moment in game development (or the study of space/time).

Perhaps the best chance for a successful movie tie in this year is Monolith's Tron 2.0. This sequel to the 1982 cult hit movie currently exists only as a video game due to ship in late August. No movie has been approved and this has given Monolith more creative control than it would have otherwise had, and has also helped the game to stand on its own.

The games industry may now rake in more moolah than the box office, but for the near future it looks like movies and the promise of easy money will continue to dominate the landscape of gaming tie-ins.
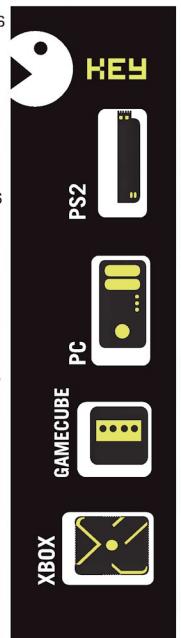
KEY

PS2

PC

GAMECUBE

XBOX

SHORT CIRCUITS

◀ Napster-killer Metallica has recently announced its attempt to get friendly again with the geeks of the world by announcing Metallica: The Game. And no, it's not Lars Ulrich's Prom Queen Makeover, or James Hetfield Forever. It's a game with futuristic cars and guns. Not so much Twisted Metal as straightened metal. And no, Trent Reznor is not doing the soundtrack.

◀ The Sims Online has been the shining failure of the massively multiplayer world, with low take-up and a tiny subscriber base. And now some enterprising players have started introducing a different set of family values to make the game interesting. A shadow government formed to keep order has now morphed into a digital mafia, complete with standover men and gangland hits. Keep your eye out for the new horse heads and baseball bats expansion.

◀ Blistering barnacles! *Issue 29* was subject to a gremlin attack and somehow the contact details for Devastation (*page 77*) were fiddled with. It's Manaccom, not Microsoft, you should call if you're after information for this frantic FPS. The phone number is (07) 3870 4900. Apologies to Manaccom for the mix-up.

BUZZWORDIKAN:
NURBS

Non-Uniform Rational B-Splines are used to increase the level of detail of a 3D model without increasing the number of polygons. The surface of a polygon is usually flat, however with NURBS and other types of Higher Ordered Surfaces developers can mathematically define a curved polygon surface, allowing for smoother models. Sony recently announced its PSP would use NURBS.

SCANNER

Pocket monsters

Unable to stop playing with himself on trains, John Gillooly searches out the next generation of public transport amusement companions.

A part from some abortive attempts by companies like Atari and Sega to muscle in on the action, the portable gaming space has been owned by Nintendo for an astronomical amount of time. From the early monochrome days of the Game and Watch to the golden years of the Game Boy, no one has managed to grab a slice of the market from Nintendo.

However 2003 marks a resurgence of interest in mobile gaming. The three contenders all come from relative positions of strength in their existing markets, and all three seem convinced that they can grab a slice of Nintendo's pie. The products in question are Nokia's N-Gage, Sony's PlayStation Portable (PSP) and newcomer Tapwave's Helix.

Nokia were the first to announce a move to mobile gaming with the N-Gage. Rather than being a purely game-focused unit like the Game Boy Advance, N-Gage draws on Nokia's strengths as a mobile phone manufacturing giant in order to deliver a unit that combines gaming, portable music and telephony in a single package.

N-Gage has been riding a wave of hype as Nokia screams from the rooftops about its bold move. Several big-name developers are onboard for N-Gage, and the range of titles for the October 7 launch is looking damn strong on paper. However it's very obvious that game publishers are just dipping their toes in the water, with most only announcing a single title for release so far, the biggest of which are: Red Faction, which is being developed by John Romero's Monkeystone games; Tony Hawk's Pro Skater; Sonic N and Tomb Raider. All of these games are versions of existing titles, and the only major new title was announced at E3. It's an as yet undefined World War II strategy-ish type game called Pathways to Glory that will mark Nokia's debut as a game publisher when it is released next year.

Sony provided this year's E3 bombshell with the completely unexpected announcement of the PSP at its press conference. There was a decent dollop of tech specs but the only tangible product shown was a prototype UMD disc. UMD is a new optical storage format that mashes elements of MiniDisc and DVD together to get something the size of a MiniDisc that can hold 1.8GB of data.

There were no game announcements, mainly because Sony is now so entrenched in the console market that it doesn't need to talk about games still over a year away from launch. But rest assured Sony will undoubtedly leverage the huge pool of talent currently developing for the PS2 to have some kick-arse titles available at launch.

Perhaps the most exciting thing underlying the PSP announcement is the combination of USB 2.0 ports, UMD and inbuilt MPEG4 decoder. This could very well spark a new era of cheap mobile video players, perhaps with the ability to download movies from your PC, but it will undoubtedly be strangled by Sony thanks to its vested interest in the movie business.

Sitting somewhere several miles below the radar is the third player, a US-based company called Tapwave (www.tapwave.com). Spawned from the ranks of Palm's executive, Tapwave is

TECH SPECS FOR PORTABLE GAME SYSTEMS

	GAME BOY ADVANCE SP	TAPWAVE HELIX	SONY PSP	N-GAGE
Processor	ARM7TDMI	i.MX1 ARM9	Unknown	ARM925 MCU
Processor speed	16.7MHz	200MHz	Unknown	104MHz
Graphics	Unified with CPU	8MB ATI IMAGEON	3D polygon engine	Unified with CPU
Resolution	240 x 160 pixels	480 x 320 pixels	480 x 272 pixels	176 x 208 pixels
Colour depth	32,000	65,536	Unknown	4,096 colours
Onboard memory	32KB on-die; 96KB video RAM; 256KB general	Main memory unknown; 8MB video memory	Unknown	3.4MB general onboard memory
Game media	Cartridge	SD-ROM	UMD 60mm optical secure disk	MMC
Game media capacity	Up to 32MB	Unknown	1.8GB	8MB by default but up to 128MB supported
Sound	Mono speakers	Stereo speakers/stereo headphone jack	Mono speakers/stereo headphone jack	Mono speakers/stereo headphone jack
Multiplayer functions	Link cable	Bluetooth	Undefined wireless functions	GPRS and Bluetooth
Operating system	Proprietary	Palm OS 5	Proprietary	Symbian
Extra functions	Gamecube link	MP3 player; DV player; Palm OS-based PDA	DV player (MPEG 4)	Mobile phone; MP3; rudimentary PDA functions

leveraging existing experience with Palm's platform and was one of the first licensees of the newly spun off PalmSource operating system developers.

Tapwave's salvo into the gaming marketing is currently codenamed Helix, and resembles a slim, rotated PDA. Tapwave was demonstrating some prototype units at E3, however they were not allowing photography as the design is yet to be finalised.

From a hardware perspective, Helix has nearly everything it needs to smash the competition. The ARM9 CPU runs at twice the speed of the one used in N-Gage, and it has a dedicated ATI IMAGEON graphics chip to take some of the load. A 2D-focused chip, IMAGEON incorporates support for hardware MPEG/JPEG decoding and also drives a range of I/O functions within a portable device. It lacks support for hardware 3D rendering, but this load has been picked up by the X-Forge 3D middleware engine developed specifically for mobile use by a company called Fathammer (www.fathammer.com).

The screen is much bigger than its competitors and it is the first unit of this kind to adopt two stalwarts of the console scene; analog controls and a rumble function. Thanks to Tapwave's roots Helix will also be a fully functional Palm PDA. The unit is set to launch sometime later this year.

With so many companies converging on this one market, the battle is set to be tough. While the range of games and years free from competition make Nintendo's Game Boy Advance a seemingly unassailable target, the nature of the competition means that the battle will not be entirely fought on Nintendo's grounds. While the GBA is just purely a gaming platform, the newcomers all focus upon being convergence devices.

Sony is perhaps best positioned to become a lasting player in the market, hampered only by the fact that PSP is not due to launch until the end of 2004. Sony pioneered mobile entertainment with the Walkman and its track record of success in the console game is unparalleled. In fact, at the PSP announcement Sony called it the Walkman of the 21st century. With genuine 3D graphics (including a focus on NURBS for increased image quality) and 1.8GB of data to play with, developers should start doing some damn scary things with PSP, which it needs to do, because the PSP is also the most narrowly focused of the devices announced so far.

Nokia has shown its hand and has put a lot of reputation and dollars behind N-Gage. This Finnish company has become a household name with its mobile phones, and the combination of this and the extensive distribution network in place should help force N-Gage into prominence. If anything, the US$299 launch price should make N-Gage the most reasonably priced high-end mobile phone yet released, which will help Nokia to get units out into people's hands. Whether those people then go and buy games will be the true litmus test of N-Gage.

In the race for the 2003 Christmas dollars, Tapwave are definitely the dark horse. On paper, Helix looks superior to the Game Boy Advance and N-Gage. However it is a complete unknown, despite the strong heritage of Palm that it has behind it. There have only been two major titles announced for Helix so far, and both have incredibly exciting potential. The first is Tony Hawk's Pro Skater (which will undoubtedly be closely compared with the version coming on N-Gage), and the second is Bioware's hardcore pseudo-3rd Edition AD&D RPG, Neverwinter Nights. This reinforces Tapwave's push towards more mature gamers, who are also more financially liquid gamers. It will be intriguing to see whether a game so involved as Neverwinter Nights will actually work in the quick-fix focused world of portable gaming.

Forget consoles, that little stoush has just gotten boring for the moment. The next war looms and it won't be fought in the living rooms of this fair land, it is being taken to the streets. Now we wait and see if it will end with a new industry, or just a new range of Pokemon titles. **JG**

DEVELOPER QUOTE OF THE MONTH:

'Game Boy is for 10-year-olds. If you're 20 or 25 years old, it's probably not a good idea to draw a Game Boy out of your pocket on a Friday night in a public space.'

Ilkka Raiskinen, Senior Vice President, Entertainment and Media Business Unit, Nokia Mobile Phones. 11 June 2003, Dow Jones Business News.

the engine room

War crafting

If there's an RTS wizard, it's Blizzard – professional brewer of AI, graphics and gameplay. But Logan Booker believes it's Blizzard's tools that really make its games shine.

Designing an RTS can be as painful as having your eyes gouged out and replaced with those from a man named Mr Yakamoto. Concepts and gameplay aside, trying to create a challenging title with highly non-fist-through-monitor provoking AI and a solid trigger/event system can be as hazardous as simultaneously lighting unequal

ABOVE: The World Editor presents you with a view similar to that of the game, along with all the necessary filters to show regions and triggers.

lengths of fuse on a couple of sticks of dynamite and praying they all go off at the same time. Every element needs to culminate in one beautiful explosion, not a series of disappointing pops.

Looking at things this way it's not hard to see why a game such as Warcraft 3 took four years to layout, design, program and polish. When you're trying to shove a Fisherman's Friend down the throat of a stagnant genre, wild changes in design concepts and even entire gameplay elements aren't unexpected. Warcraft 3, for instance, started out with six sides – two
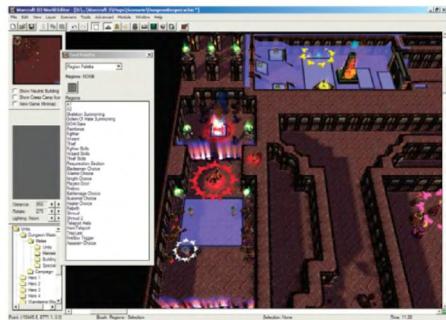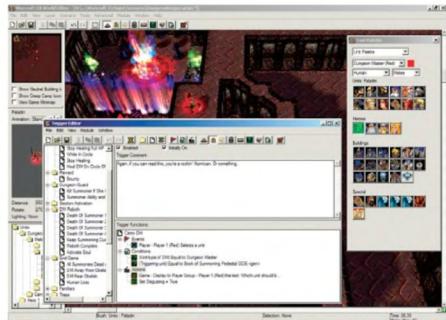
were culled before final side balancing was done. Blizzard's programmer's found it hard to scale six sides – the game had already been delayed countless times, so time was also an issue – and the extra races were dropped.

Work began on Warcraft 3 right after Starcraft was finished, sometime late 1998. Few may remember the 'sneak peek' shots of Starcraft using the original Warcraft 2 engine (see right). We can set that shudder aside as Starcraft used its own engine and the only code common between the two was network-related. It had the same 8-bit (256 colours) colour depth and 'stunning' 640 x 480 resolution as Warcraft 2. Starcraft didn't exactly signify a huge leap in the technology stakes, and its FPS brethren overtook it in the graphics department. Not really a major concern, considering this wasn't where development had been focused.

■ STAR SIGNS

The real upgrade (and perhaps the twinkling start of Warcraft 3) came in the form of Starcraft's Campaign Editor, known as StarEdit. It was the most versatile editing application to ever ship with a game. It was a devtool straight from the developer's hard drive. StarEdit gave modders the power of a versatile scripting language presented as an easy-to-use trigger system. By setting up regions and events, Starcraft became more than just an RTS.

In contrast, the editors that came with the original Warcraft and Warcraft 2 were fairly simple. Warcraft 2's map maker didn't allow access to its basic trigger system, and Warcraft 1's effort was nothing more than a unit editor. Warcraft 2 and Warcraft 3 didn't come with 'global' unit editors – unit data is instead stored in each map file, and this information is loaded with the map instead of the defaults. So you could only

ABOVE: A pre-made map to show off the Crypt Lord.

RIGHT: Blizzard wanted to see how Starcraft would look in Warcraft. It wasn't good.
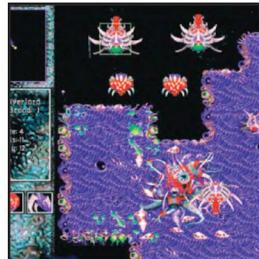
have custom units on custom maps – unless you wanted to do some PUD and WAR hacking (the resource file extensions for Warcraft 2; Warcraft 3 uses Blizzard's proprietary file format, called MPQ. And hacking this is very naughty).

With the release of Warcraft 3, the trigger system seen in Starcraft and the interface that controlled it received a massive update. Along with a bunch of new actions, events and conditions (which we'll discuss shortly), Warcraft's World Editor imparted the ability to import sound and graphics (there's a 4MB limit on custom resources though, so MP3s over WAVs, thanks). It was so incredibly better it made StarEdit look like a cookie cutter (as opposed to a combine harvester). Modders were also given the option to program using the scripting language directly; however there's little

documentation available for it.

Bill Roper, Vice President at Blizzard, informed us of a specific upgrade to the trigger system in Frozen Throne. 'In the Orc campaign, there's a massive doorway held by an archmage,' he said. Bill went on to say that the door and its condition were preserved between levels. This information is stored in a 'game cache', accessible in the World Editor using trigger actions. You can store information on units and heroes, and allows for more in-depth campaigns.

It sounds difficult to set up. It is. But lucky for us, the Trigger module in the World Editor is straightforward. The tricky part is making sure all the values you use are referenced correctly – when it comes to configuring targets for actions and what not, the interface isn't forgiving. Deeply-nested triggers can be a frucker to fix if you decide to change a variable name or the type of action, as all the variables you carefully entered using the mess of drop-down menus will become deselected.

Once you understand the basic concepts though it really isn't hard. Especially if you're planning on making a melee map (basic FFA or team game), in which case all you need to do is place terrain and start points.

TRIGGER-HAPPY

Each trigger comprises of three sections:

Events: This is where you define how the trigger is, well, triggered. Warcraft can catch almost any type of event, including unit deaths and creation, a hero acquiring an item, a hero levelling, movement in an area and the time of day. Events can be deeply nestled (event within an event), but it's best to keep them simple. Overly complex events can make implementing conditions harder as there's more to 'catch'.

BELOW: Warcraft 3 has excellent cinematics, such as this crow from the game's intro movie.
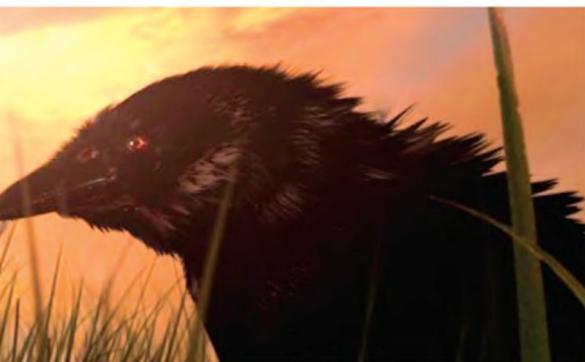
Conditions: Once an event occurs, it has to meet a certain set of criteria before the trigger can continue. You might want to check the type of unit causing the trigger to occur, what items they are carrying, how much health they have or you might want to check a custom variable. Make sure when you specify the triggering unit that you use the correct value to pick out the unit. By default, the World Editor will use 'Triggering Unit', which should work. But it doesn't. If the event is a unit dying, use the 'Dying Unit' value. Forget this, and you'll be in for some headaches later on.

Actions: With the event occurring (until the entire trigger resolves, the event is still 'occurring' so you can continue to use the 'Dying Unit' value) and conditions meet, actions can be taken. You can even store the unit in a variable to refer to it later – sometimes useful when tracking heroes. This is where the strength of the World Editor shines; and you'll be gob-smacked by the sheer number of actions you can perform.

ICE AGE

With the release of Frozen Throne, the World Editor has seen another update. Basically, everything that had been missing in Reign of Chaos appears in Frozen Throne. This includes an AI editor for creating custom mission scripts, where the computer needs to tech (research upgrades) and grant hero abilities in a particular order; a unified Object editor that replaces the Unit editor and allows the alteration of not only units, but items, doodads (rocks, trees, miscellaneous map crap), abilities and upgrades; and a tweaked Terrain editor.

Blizzard has done plenty of work to get its development tools and its games to the level they're currently at. In fact, World of Warcraft, Blizzard's upcoming MMORPG, shares a common code base with Warcraft 3 – it's that flexible.
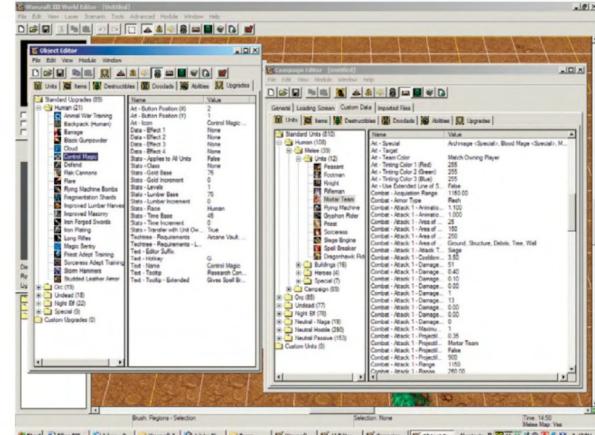
ABOVE: The sheer number of things you can edit in the World Editor is simply amazing. Loads of power. . . if you can handle it.

Development branched off only when work was started on the online component. Not bad considering the engine that powers Warcraft 3 has no name. . .

If you're interested, visit Warcraft Workshop [www.warcraftworkshop.co.uk/tutorials.php] for some World Editor tutorials – enough to get your hands dirty. **LB**
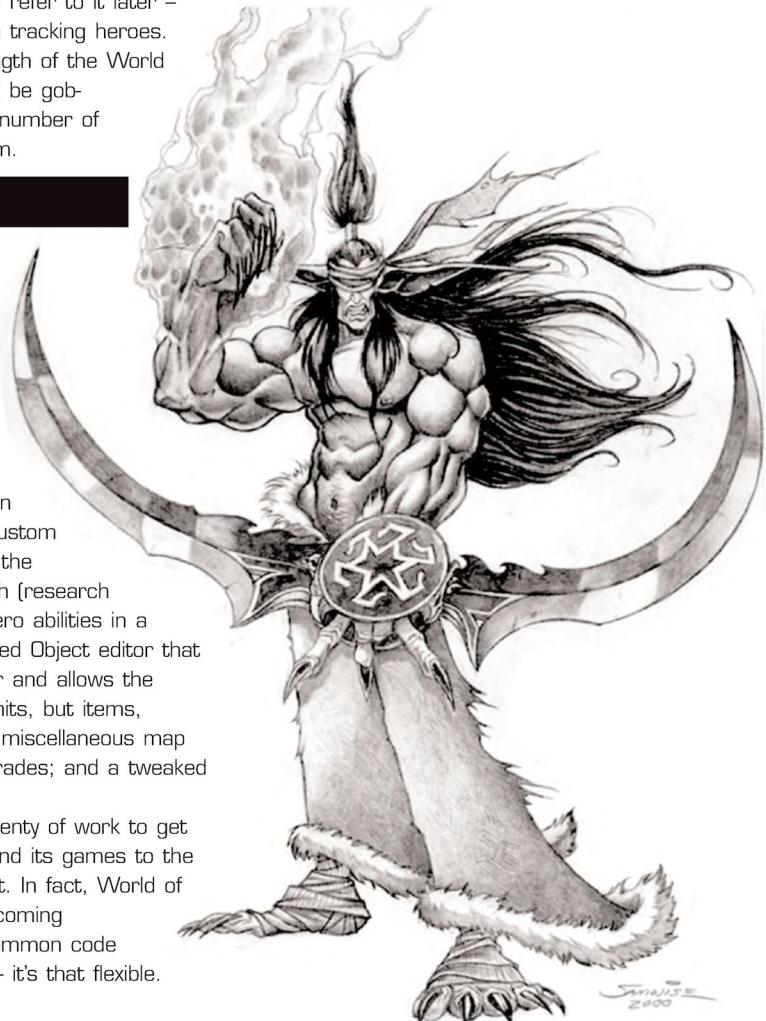
Planetside <<<<

John Gillooly joins the inter continental battle field in search of supremacy.

This AMS mobile respawn and ressupply station is unguarded and in serious trouble.

Battles can be huge, raging in air and on land as factions vie for facility control.

Several squads board Galaxy dropships and head out to the front lines.

Few first person shooters have survived and blossomed in the online multiplayer stakes. On one hand you have the run-and-gun of deathmatch and later Counter-Strike and Battlefield 1942, on the other you there's the depth of Tribes. Now, in a fresh twist we have a genuinely new genre. Planetside by Sony Online Entertainment (SOE) is the first massively multiplayer implementation of the shooter, taking the complexity of Tribes to a whole new level while moving away from its focus on jetpacking and skiing.

Set on a planet known as Auraxis, Planetside pits three factions against one another in a constant war over control of the landmasses. Rather than setting the game on one huge chunk of terra firma, the designers chose to split the world into continents. This not only allows for definite spheres of control, but also helps to manage player numbers and minimise lag.

In order to control territory, you must progressively capture and secure the bases contained within them. This is done through hacking – a clever ploy created to stop the game becoming a rapidly flip-flopping affair. Once you have fought your way into a base's control room you'll have to whip out your REK (Remote Electronics Kit) and access its console. If you can take control of the room for 15 minutes, the facility becomes property of your faction.

This makes for defined battle fronts and coordinated pushes, further reinforced by the structure of the factions. Each individual can go it alone, but for mucho shared experience and the thrill of a coordinated attack you'll want to be part of a squad. A squad is a group of up to 10 people that fight together either on their own or part of a larger group, sharing experience points along the way.

There are also larger clan-like groups known as outfits, to which members contribute experience points. Outfits allow for better coordination of large battles and make finding a decent squad much easier. Plus you get a cool little outfit logo on your armour and vehicles.

As Planetside is a Massively Multiplayer Online Game (MMOG), a role-playing element is needed to reward time spent playing and encourage players to keep subscribing. These come in the form of certifications and implants. As you gain points you increase in battle rank and gain a certification point. These can then be spent to access new armour types, weapons, vehicles and combat abilities such as engineering, medicine or hacking. This encourages specialisation as each new certification opens up new aspects of gameplay.

Implants are given after multiple battle rank increases, and add new abilities such as IFF (Identify Friend or Foe)-like targeting, enhanced weapon zoom and better running speed. Implants and certifications can be traded in for new ones, with a time delay to stop you chopping and changing too often.

Graphically the game is very competent. The detailed undergrowth suffers from an annoying tendency to pop-up a few metres in front of you, but apart from that the view distance is huge and each continent has a distinct look to it. Units and vehicles look great, from the lumbering MAX exosuit armour to the stylish cloaking effects of infiltration armour. Slowdowns only really occur during big battles when there are 50 or more players on screen.

The only issue is lag. Seeing as Australia is a minnow in the MMOG waters there is no local server (don't feel too hard done by though, Europe only has one), so gaming needs to be done on a 200ish ping to the states. Thankfully, Planetside copes pretty well with latency, and even with these sort of pings you can still hit enemies easily, although the occasional dying from bullets fired at you five seconds ago does happen.

Planetside is a gift from on high for those looking for a deep, ongoing shooter experience – Tribes players wandering the wilderness after the promising start for Tribes 2 died off and those wanting to try the MMOG genre but hate the thought of smiting orcs. The best news is that because of the monthly fee, the dickhead factor that permeates Counter-Strike should be non-existent. The game costs $US12.99 a month to play, which is worth it if you want to avoid the horrors of the free-for-all on public servers. Planetside has a depth rarely seen in this type of game and offers one of the finest team-playing experiences out there. If only there was an Aussie server. **O**

8.5/10

O: Deep, ongoing team-play experience; extensive customisation and role playing elements.
O: Occasional lag due to US-based servers.

GAME DETAILS

REQUIREMENTS: 1GHz CPU; 256MB RAM; 32MB video card; 3.25GB HDD; Internet connection.
RECOMMENDED: 1GHz CPU; 512MB RAM; 64MB DX 8-level video; broadband Internet connection.
DEVELOPER: Sony Online Entertainment www.station.sony.com
PUBLISHER: Sony Online Entertainment www.station.sony.com
DISTRIBUTOR: Ubisoft www.ubisoft.com **PHONE:** (02) 8303 1806

Warcraft 3: The Frozen Throne <<<

With an insane grin, Logan Booker faces the fresh, icy breath of destiny.

The Crypt Lord's Impale ability *really* hurts, particularly if you're an orge in a loincloth.

Mountain giants are great as siege units once they're equipped with tree trunks.

A Shadow Hunter bravely defends his falling base with Serpent wards.

Few games can boast the same legacy of relentless success earned by Blizzard's Warcraft series. While the first was an instant classic, its sequel in 1995 defined Blizzard as an ambrosial prince of the RTS genre. However while it was instantly playable, many gamers complained about the lack of unit variety between sides. Spurned by the community's need for diversity, Blizzard worked hard on the third title, pushing its release date ever backwards to perfect the shine. Finally, Warcraft 3 was released mid-2002, and yet again demanded unwavering attention. And yes, god damn, it was fun.

Here we are, mid-2003, and Blizzard has released The Frozen Throne, an expansion that perfectly complements the single player and multiplayer aspects of Warcraft 3. Along with a load of new missions, it oozes fresh units, items, buildings and gameplay mechanics – this last item being the most notable. In fact, the change in play dynamics is so intense you'll find yourself being pounded many times over before you get a hang of the changes.

Frozen Throne continues the Warcraft 3 story with Illidan, an evil, demonic Night Elf who's been released from his prison below the earth's surface. With the Human city of Dalaran in ruins and the Night Elves' Grove tainted, the races of Azeroth aren't in a state to stop his plans to recover the Eye of Sargeras, a corrupt artifact of immense power. Rallying behind him are the remnants of the Burning Legion (Undead) and the Naga, a race that's risen from its slumber beneath the seas. Very ominous.

But Blizzard's never been a developer to use a non-linear story in any of its RTS titles, and Frozen Throne is no different. While the single player campaign includes a number of new triggers and characters, there's no way to dismiss the 'led by the hand' feel. And after looking at the *unbelievably* improved World Editor, it's hard to find a solid reason for the on-rails story other than time constraints.

It's easy to get past this as the rest of the game is fantastic. As has been mentioned, few game elements have been left untouched. Each side has a new hero, who for the most part addresses a race weakness while adding some genuinely useful powers. The Undead Crypt Lord, for example, is easily identifiable as a 'tank' unit. Along with powerful melee abilities, including Impale, which fires huge spikes from the ground directly ahead of the Crypt Lord, the hero has loads of hit points and dishes out ferocious damage with its claws. For the Orcs there's the Shadow Hunter, equipped with a spell called Healing Wave. It bounces between friendly units, providing less and less health as it goes. This addresses the Orcs inability to heal early-on, and is a definite balance changer.

To supplement the new heroes is a set of neutral ones that can be recruited at Taverns during multiplayer. With the same gold and lumber cost as a race hero, they can be a useful alternative to help combat certain creeps or pass obstacles. Also, monster camps are now marked on the mini-map, with green for level 1-3 creeps, orange for level 3-5 creeps and red for creeps of level 5 and above.

Units overall are cheaper, speeding up gameplay compared to straight Warcraft 3. Altars for summoning heroes are almost half-price, and while you'd think this would give sides such as the Night Elves and Undead an unfair advantage (thanks to their early harassing tactics), base troops such as Orc Grunts are now much cheaper, while still being expensive compared to Ghouls. Each side also has an item-producing structure (Voodoo Lounge for Orcs, Tomb of Relics for Undead etc), where healing potions and race-specific gear can be purchased. There's also a new unit upgrade available to all sides called Backpack that gives certain ground troops the ability to carry items, so you can ferry things between heroes or haul around excess booty.

Enemy AI has become very aggressive; Blizzard has tweaked the scripts to make the computer push harder for expansions and to attack more strategically. Its omnipotence seems to have been improved as well, and now more than ever your gold mines and bases are at risk from a 'surprise' rush.

Warcraft 3: The Frozen Throne is terrific fun. How Blizzard continues to put out genuinely fresh expansions is a mystery – again the king of RTS (with Westwood just a memory) has come through with a tight package that'll have you wondering how you managed without it.

atomic | MAXIMUM POWER COMPUTING | **9.5/10**

GAME DETAILS

REQUIREMENTS: 600MHz CPU; 128MB RAM; 600MB hard drive space; DirectX video card.
RECOMMENDED: 1.2GHz CPU; 256MB RAM; 32MB T&L video card.
DEVELOPER: Blizzard Entertainment www.blizzard.com
PUBLISHER: Vivendi Universal www.vugames.com
DISTRIBUTOR: Vivendi Universal www.vugames.com
PRICE: $60.00 **PHONE:** Vivendi Universal (02) 9978 7722

Completely new gameplay dynamics; fresh units and abilities; impressive and powerful World Editor; a bunch of miscellaneous tweaks to unit statistics.

Linear storyline; new dynamic may not please long-time Warcraft 3 players; World Editor can be overwhelming.
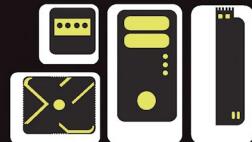
Gaming re-invented...

MantaRay®
by digislide

The Hulk <<<

According to Nathan Davis, the name of this game couldn't be more appropriate.

Being Bruce Banner. . . nothing could be more boring. We want GREEN!

'Smash tactics' sounds like 'smash-tastic'. But it's not.

The Hulk's game world is just jam-packed with throwy things. Including helicopters.

For some reason the colour green has the ability to conjure up images of the insane. In keeping with this, mean green guys appear in a large majority of superhero games and movies as freaky dudes that perform evilly bizarre acts. Well, here's another of these crazy green fellas, but finally coming in the shape of our favourite raging vehicle-throwing superhero – Bruce Banner's alter ego.

The Hulk is another addition to the rapidly growing collection of movie-to-game adaptations. Continuing on from the movie, after destroying San Francisco, Banner is now on a mission to find and retrieve a 'Gamma Orb' from an evil scientist who, when he uses it, can replicate Hulk's powers into his own wicked creations. That's the base story throughout the entire game.

Not surprisingly it's tied in with the movie release, appearing on store shelves just prior to the movie screening so you can get all your Hulky juices ready and pumping. Publisher Vivendi Studios ensured there was a good dollop of hype surrounding this game. They even videoed the game developers excitedly ranting about the graphics and physics engine – from the way objects interact with each other to how no two breakages will ever look the same.

This of course means you have the ability to pick things up and hurtle them through the air or simply hold on and use as a melee weapon. Like the developers raved, moveable objects do have a degree of interaction with each other. For example, if you hurl one crate at another,

chances are they will both explode and cause a reaction on any other object nearby. Realistically these are just very basic reactive measures. Tetris anyone?

This sets the scene for immense amounts of smashing, crashing and flinging of objects around ubiquitously. Objects like chunks of electricity generators, guards and truck containers. This is absolute smash-up-shit heaven. . . for the first hour, with a doubling in percentage of blood-alcohol levels required every hour thereafter. Unfortunately the focus has been set far too high on the design elements and not on gameplay.

Enemies range from guards, gamma dogs (massive gamma-affected dog-like creatures) gun turrets and of course, the snarling big boss at the end of each level. The overall AI is somewhat lacking, but this was mostly foiled by having forever spawning enemies. Which would've worked out well had the Hulk's fighting lethality been a little higher than that needed for a butterfly kill.

In order to move between areas, the kicking of entire walls is almost always a requirement. That is except for when you're in Banner form, in which there are some doors that are 'security locked' with a stupidly basic puzzle. These puzzles seriously lack any clever thought at all.

They've attempted to slip a bit of stealth into this game. On several levels you revert back to being your usual pathetically weak self who has to sneak around an entire level doing, well,

sneaking. You're not allowed to be seen because any bad guys will instantly start attacking you (screw negotiation) causing your anger levels to soar, thus leading to the revealing of your inner green self. Doing so makes you fail that level. This is in all honesty boring and tedious – why hide when you have so much power under your skin? Fortunately the larger portion of the game is played as the Hulk.

One major gripe was the tragic camera handling. You could be walking forward one minute, carefully avoiding a spotlight, then suddenly the camera will change and you lumber directly in full view of everyone because the controller's direction has changed with the camera. It hardly shows a good angle, making everything rather challenging, and unfortunately, there is no way for the player to control the game camera manually.

Overall, The Hulk is another mediocre movie to game conversion that rapidly degrades into an extremely repetitive title with a linear storyline. Though fun for a quick smash period, beating the shit out of everything in site doesn't exactly make for a deeply thrilling game. It tends to grow old rather fast, depleting into one especially tedious finger-clicking session.

4/10

GAME DETAILS

DEVELOPER: Radical Entertainment www.radical.ca
PUBLISHER: Universal Interactive www.universalinteractive.com
DISTRIBUTOR: Vivendi Universal www.vugames.com
PHONE: Vivendi Universal (02) 9978 7722

Become the ultimate mean green killing machine; fast, quick and clean smash 'em up.
Hulk not lethal enough; extremely repetitive gameplay; linear story; appalling camera; Enter the Matrix at least had extra movie footage.

Colin McRae Rally 3 <<<

George Soropos and Colin McRae have a 'minor disagreement' in the mud.
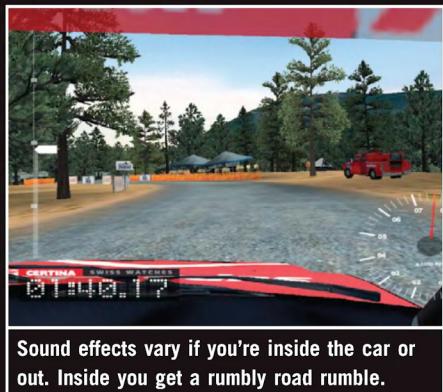
Sound effects vary if you're inside the car or out. Inside you get a rumbly road rumble.

Looking up the rear of Colin's throaty exhaust howl. Ow! Now I've got dust in my eyes!

Not that left, Colin, the other left. That's the boy. Very long easy right. Jump, baby.

'I am afraid that the only multiplayer option is split screen. There are no network or Internet options, sorry.' Codemasters Customer Service, Codemasters CMR3 Forum.

It's an unusual way to begin a review, but it perfectly sums up most of what's wrong with not only the Colin McRae Rally 3 game on PC, but also the attitude behind its release. The last installment of the McRae series was mostly accepted by the PC community, but not without a few gripes, and it was hoped Codemasters would learn from the experience. Sadly Colin McRae on PC is a game designed from an accountant's office, not a game developer's, and the only thing that accountants learn from experience is how to find ways to screw people even harder.

There are a few problems with the actual conception of the game, but before we go there let's look at the problems associated with its console nature. If you use a Microsoft or Logitech wheel may find the pedals won't calibrate correctly or register as y-axis controllers, putting you in a situation where you can have a brake or accelerator, but not both! The CMR3 code also overrides Microsoft's controller setup software and disables settings such as the auto-return feature. Which is nice. Audio scratching and dropouts are not uncommon either, particularly with Fortissimo cards. There also seem to be some missing crash effects – either that or your car is made of Nerf.

The marketing screenshots for Colin McRae 3 look amazing but are unfortunately just bum fluff. This is a game written for a 24MB PS2 so the scope

of the landscape and scenery is very limited. Sure the actual cars look great, but as this is a rally game you don't actually see them (except in the marketing screenshots of course) and while the recommended requirements for the game state 512MB RAM, its extremely difficult to understand why this is so as the roadside graphics are just painted curtains, the spectators cardboard dolls and the horizon a dodgy backdrop.

The absolute worst thing about the port-like nature of this game is that Codemasters hasn't seen fit to add any online support. For many, online racing is the only kind there is. For a decision like this to be made at a time when more people are gaming online than ever, one has to believe Codemasters didn't want to spend the money paying anyone to do it. It made the effort for CMR2, which many still play – quite a few now-disappointed people who were looking forward to CMR3. The truth is, now that the PS2 and Xbox are out there in numbers, developers like Codemasters are seeing the PC as an albatross around their necks that needs to be tolerated but not truly supported.

Are there too many PC configurations for developers to test economically? Nonsense: with only two grahpics chipsets (GeForce and RADEON) three or four audio chipsets and DX 9, PC developers have never had it so easy! Codemasters, you have no excuse. And speaking of the inexcusable, Codemasters has adopted the practise of locking features away unless gamers pay. All new Codemasters titles try and double-dip into your pockets by making you phone the UK and pay an

extra $US5 (on top of whatever it costs to call!) for an unlocking code to get at the extras. As Derryn Hinch used to say: shame, shame, shame!

Aside from those significant issues, there are unfortunately also problems with the overall conception of the game. There are only two modes of play, Championship and Stage. Championship mode recreates the whole race weekend in depth and would have been quite good if it weren't for the fact you can only play as Colin, and therefore only use the Ford Focus (McRae actually drives for Citroen now) This mode is where you 'unlock' cars and tracks to play in the Stage mode. Without online play though the mode is quite boring and Colin McRae's replay value is consequently very limited.

It really is sad when you have to say a game like this has no competition on the PC, but it's true. Colin McRae 3's cars are nice to drive and if you're after a bit of casual single player fun it's quite capable if you can sort out the controller problems. However, if top notch online racing is what you're after take a look at Live For Speed (www.liveforspeed.com) Gaze upon it and be ashamed Codemasters. It isn't rally but here is a racer developed by two (count them, two – that's two) guys that make your game look lame and stupid. Colin McRae Rally 3: Codemasters worst PC game ever. ▢

4/10

▢: A new outing for a rare genre these days; technical improvements over older titles.
▢: Pay for secrets; very much a console port; no mouse or online play. Championship mode limited to McRae's Ford Focus, numerous audio and wheel setup bugs.

Safety hat optional

Dan Rutter's back on-site to rebuild the mess you've made of your brand new, real-real-shiny PC. Or old, smells-like-ozone VAC. As ozone-leaking components are bad things, you'd best replace them with an odourless and awesome MX700, won every month by IOOTM.

IOOTM:

Goodbye to VHS

I am interested in buying a video card mainly for recording television/video. There are two cards I am choosing from, the 64MB All-In-Wonder RADEON 9000 PRO ($423) and the 128MB All-In-Wonder RADEON 9700 PRO ($749). I have read that both use the same RAGE THEATER 200 chip and the same Philips tuner. Therefore, my question to you is, will the uber-powerful 256-bit memory controller of the 9700 PRO offer better quality recordings compared to the lower 128-bit memory controller of the 9000 PRO?
Stephen Q

O Yes, those two cards do have the same tuner and video decoding hardware. So, for that matter, does the cheaper RADEON 7500-based All-In-Wonder VE.

The 9700's a much more powerful 3D card than the 9000 PRO, but its memory controller doesn't do a bloody thing for video encoding.

The AIW 9700 PRO *is*, however, a slightly more capable video capture card, because the R300 core of the 9700 has

a 'Cobra MPEG2 engine' which takes a bit of the load off the CPU when you're encoding video. ATI claims it can reduce CPU load by as much as 25%, but in reality 10% seems to be about the most you're going to see. Certainly less than 20%.

No current processor has any trouble with even ten megabit per second MPEG2 encoding in real time. If your CPU is faster than an original model P4 (or 1GHz Athlon), you'll be fine without the extra help.

Real 'capture cards' (generally meant for video editing systems) have on-board encoders that do MPEG-something or Motion JPEG (which is easily editable – MPEG isn't), and don't

require any CPU time to do it.

CPUs are so fast these days though, that you just don't need this extra hardware for basic 'digital VCR' purposes.

The R300 core also provides a 'VideoSoap' function to reduce noise in low quality incoming video, which gives a better picture and a smaller MPEG file. This uses considerable CPU power as well, though, and it's no use if the video isn't actually noisy.

■ MUST...GO...FASTER

I In the last year or so, we have seen the speed of CD burners crawl up from 8x to 52x, but the read speed hasn't improved much, if at all! Why is this? Have companies given up going faster?

Personally I would like it to be higher, as most games and software are still on CDs and multiple CDs (Enter the Matrix, for example) take forever to install! Norton Ghost could run faster with a faster CD read speed, thus decreasing the time spent on reinstalling after a fatal crash.

Have companies called it quits at 52x speed? Is it impossible to go faster?
Kenny

O Yes, 52x is a bit of a limit. 52x CD-ROM *readers* have been around for a long time; recently, burners that can do the same speed in write mode (in theory at least, with good enough media and when the phase of the moon is favourable) have turned up too.

52x isn't a barrier like the speed of light; you *could* make a drive that worked faster, and someone probably will. But it's getting very difficult, because CD-ROM discs are not manufactured to the same tolerances as hard disk platters, and they're not as strong, either.

At a glance, a CD looks very nicely round and the hole in the middle looks very nicely centred. But it's not perfectly round, and there's probably stuff printed on it too, which can further spoil its centre of gravity.

If you start spinning such an imperfect disc *really* quickly, you're going to get vibration. Quality CD and DVD-ROM drives have clamps that centre the disc very well, and many of them also have vibration damping gadgets of one kind or another. But there's only so much you can do.

It's also possible for discs to actually fly apart if you spin them too fast. Yes, even though they're made of super-tough polycarbonate.

Full '52x' rotational speed is fifty-two times the minimum rotational speed of the original '1x' CD-ROM drives, which spun at the same speed as audio CD players. 1x is 210 revolutions per minute – that's how fast an audio CD player spins when it's

010100110
110111101
100011011
010110110
010101110
100001000
000011011
100100000
011001100
110111101
110010011
001010111
011001100
101011100
10

playing the very end of a completely full disc. It spins faster at the beginning of the disc, (because CDs are recorded from the middle out and the data rate per unit length of track is constant), but the 'x' figures are all multiples of the minimum 1x speed, because that makes the numbers more impressive.

Modern CD-ROM drives don't use the old drives' Constant Linear Velocity (CLV) variable-speed system; they stick to Constant Angular Velocity (CAV), and spin at the same rpm no matter what part of the disc they're dealing with. CD writers *may* vary their speed if they're writing at a speed below their maximum mechanical capacity, so as to maintain much the same data rate over the whole disc, but they don't necessarily.

Anyway, 52x is 10,920rpm. Which is bloody fast. A CD has a circumference of 377mm; 10,920 x 377mm/m equals 247km/h, around twice the edge speed of a circular saw. At this speed, a weakness in a disc can, at a random moment, produce a loud noise and a drive full of CD fragments. Going faster only makes vibration and exploding-CD problems worse.

We're already at the point where some drives default to a reduced speed 'quiet' mode; you have to power them up with a button held down to get them to run at the full sticker speed.

■ POWERING ON

I I own an older server case with 300W redundant power supply units, and I wonder if it is possible to use it with a new Pentium 4 mobo? There is a spare P2 AUX plug. Can I use it with a proper adaptor?
Maszko

O Yes, provided the PSU has an ATX plug for its main output. The four-pin ATX12V 'P4 connector' on most motherboards today is just for extra 12 volt power; you can buy inexpensive adapters that let you use a standard 'Molex' drive power plug for that.

■ HT HOPE SPRINGS ETERNAL

I In *issue 23* there was an article about P4 Hyper-Threading. In that article it stated that all Pentium 4's had Hyper-Threading built into them, so does that mean my Willamette core P4 1.5GHz with 256KB of cache can be Hyper-Threaded too?
Van Kansaki

BELOW: Hyper-Threading may sound hyper cool, but having a P4 with a two personalities isn't always fun. Especially if they fight.

The only P4s with HT are the 800MHz FSB chips (the 'C' models), and the 3.066GHz 533MHz FSB P4, which was the flagship chip before the 800MHz bus P4s arrived. No other P4s have HT.

HT isn't worth getting tremendously excited about, anyway. It *does* provide a small speed boost, generally, provided your operating system and motherboard and are able to turn it on, which is not a problem for Win2000/XP and pretty much any current Socket 478 board. But a P4 with HT is *not* the same as a real dual-processor system. Both HT pseudo-processors are competing for the same resources from the cache level on downwards, which massively bottlenecks their performance.

■ COMPRESSION SWINDLE?

I I am a Telstra dial-up customer. I was looking at my dial-up connection and noticed the compression setting. This got me wondering if I'm doing them a favour by compressing my data, but do they compress the data they send to me? According to my dial-up status dialog, no, which means I chew through my available megabytes quicker than if I did. Also, wouldn't this apply to broadband customers too? Why doesn't Telstra and for that matter any other ISP use compression on their end?
Heath Dimmack

O There are two kinds of compression that can be used on the data being sent over a dial-up Internet connection. That data may *already* be compressed, if you're downloading Zip files or JPEG images or some other compressed file format; in that case, the other compression won't do any good.

Anyway, the first kind of compression is v.42bis, done between your modem and the modem at the ISP's end of the line. In theory, v.42bis can manage 4:1 compression; in reality, it'll deliver about 3:1 on highly compressible data like text files and HTML files. That gives a data stream that fits quite nicely into 115,200b/s, so that's the speed a serial-interface modem's serial port should be set to.

And then there's IP header compression, also done between you and your ISP. It reduces the size of IP packet headers, and can help considerably when you're trying to do interactive Internet activities, including games, over a modem connection; it practically eliminates latency caused by packet headers. IP header compression has no significant impact on downloads, only on the snappiness of your interactions with servers.

Both forms of compression operate between you and the ISP, though, not from you *through* the ISP to another server. The ISP has to get the same amount of data from the Internet, and pass it on to you, whether you use compression or not.

Compression certainly can help conserve download allowance, if you're downloading files from somewhere and you get, say, the 16 megabyte zipped version of a Web server's logs instead of the 200 megabyte unzipped version. But the kinds of compression you're talking about just make your connection a bit faster. They make no difference to the amount of data that passes through your ISP.

■ LIVING ON THE EDGE

I I am aware that hard drive transfer rates are greater towards the outer edge of the platter. I would like to know if I can improve hard drive performance by placing my data towards the outer edge. The best way may be to create two partitions, and store my data on the 2nd partition. What do you think?
Daniel Black

io@atomicmpc.com.au

That depends on what you mean by 'performance'.

Hard drives spin at a constant speed and record data at a constant density, so their outer tracks *are* faster, at least as far as sustained transfer rate goes, because more data per second passes under the heads. Sustained transfer rate isn't very important for most PC tasks, though, because the drive doesn't often need to read single contiguous enormous files. It doesn't need to do that when it's accessing the swap file either; the swap file should, ideally, *be* contiguous, but the computer never reads or writes its way through the whole thing. It just moves chunks of data in and out of swap as necessary.

Cheap commodity hard drives these days all have very fast sustained transfer speed, thanks to their huge capacity and the resulting enormous data density on the platters. Seek speed now matters more.

The faster the drive can move its head assembly from one spot to another, and the sooner the spot it's looking for spins around under the head (rotational latency), the sooner it can start *using* that very fast transfer rate.

The further the heads have to move, the longer the seek time will be. For this reason, putting the swap file, or anything else you access a lot, on the edge of the platters can actually be counter-productive, as you're guaranteeing that every time you access swap, you'll be seeking all the way to the edge of the disk. A swap file about two-thirds of the way between the centre of the platter and the edge (which means half of the drive's capacity will be on one side of it and half will be on the other) is, on average, closer to everything.

LOOPING THE LOOP

Of all the computers I have built of late, this must be the worst. AMD Barton 2800+ on an Epox 8K9A2+, with Sapphire 9700 PRO video. After BIOS upgrades, new drivers all round, tweaking BIOS, playing with advanced settings, and communicating with ATI, Sapphire, Epox and AMD, I still get this 'the driver for the display device was unable to complete a drawing operation' error on boot, still have corrupt graphics, and still have system hangs (or auto reboots) when I try to play V8 Supercar and NFSHP2.

New ATI and Sapphire drivers actually make it *worse*, even though they report a 9700 PRO instead of 9700 SERIES video

ABOVE: The great thing about Windows error messages is how they really help you figure out the problem.

card. ATI gave a long list of ideas, all of which I had already tried. The problems under Win98 aren't as bad as WinXP, but I would rather run the newer OS I have paid for. Could you please, please (on bent knee) think of something? This is supposed to be cutting edge computing!
Peter Harries

Welcome to the loop error! Isn't it fun?

There are lots of possible causes of this sort of error, which can happen on any flavour of Windows but which usually, if not always, manifests in the way you describe on WinXP machines. It can be caused by faulty software, faulty hardware, over-enthusiastic BIOS settings, or a lousy PSU.

It's generally a good idea to have a spare PSU on your shelf all the time, so you might as well get a decent one, swap it, and see if the problem goes away. It's a pretty painless piece of shotgun debugging. If it doesn't help, then you still get a spare PSU out of the deal, which is a handy thing to have. PSUs in important computers always explode at five in the afternoon on Saturday. Always.

There are plenty of other things that can cause the problem, though. This piece lists them all:

http://www.viaarena.com/?PageID=64

[Peter got back to me, though. As it turned out, it was indeed the PSU at fault!]

A DAY LATE, 33MHZ SHORT

I have recently built my new PC, the one I'm writing this with.It has an Athlon XP 2200+; 256MB DDR333 RAM and a GA-7VAXP mobo. To my understanding, all XP 2200+ CPUs have the Thoroughbred core, but also to my understanding all Thoroughbreds have a FSB of 166MHz. But WCPUID says my FSB is only 133.95MHz. Is there something wrong here?

Also, my RAM is running at 267.91MHz; isn't DDR333 meant to operate at 333MHz?
**Brendan Wilde**

Yes, all Athlon XP 2200+s are Thoroughbred-core CPUs, but they come in both 133 and 166MHz versions. You just have a Thoroughbred-core 133MHz FSB XP 2200+.

This explains why your RAM's running slower than its rated speed. Many motherboards will let you run it faster than your FSB speed, and it should be perfectly happy at 333MHz (after DDR doubling), but you'll see no real speed improvement if you do that and leave your FSB at 133MHz.

Fortunately, the difference between 133 and 166MHz FSB, with the same core clock speed, is slight. Your computer is very likely to be able to manage a 10% overclock (to about 147MHz FSB). If you do that, then you're unlikely to notice the difference, but you'll still have achieved more of a performance boost than you'd get by swapping to a 166MHz-FSB XP 2200+ and running it at stock speed.

PHR33X TW33X
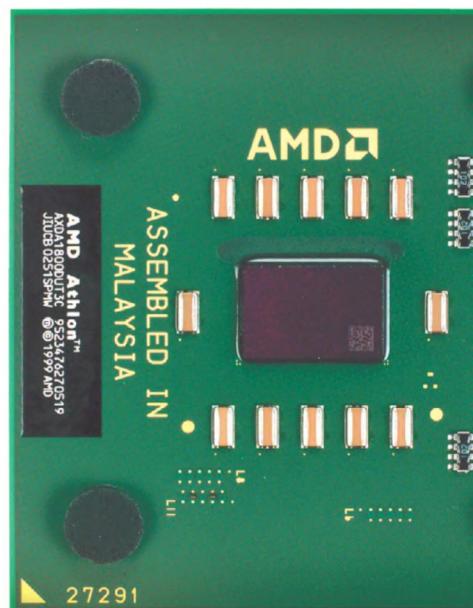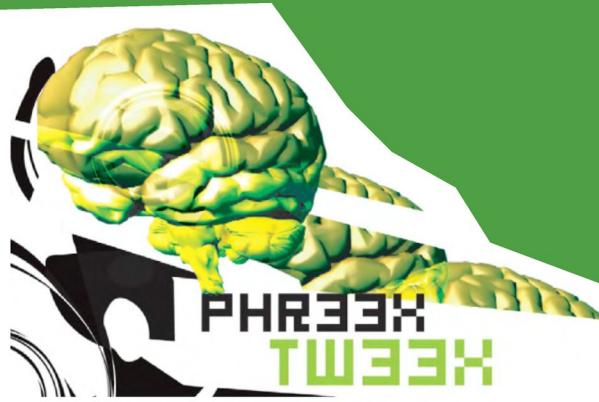
Once upon a midnight dreary, while I tweakOred, weak and weary. Over many a caffeine beverage and chewed up apple core. While I modded, heart a-flapping, suddenly there came a tapping. As my inbox had received a message, some more spam, I was sure. 'T is a tweak,' I muttered, 'begging to be tested swiftly. Only this and nothing more.'

■ GOOD MEMORY

This tweak is for your RAM. Tell Windows to stop swapping out the good bits to the pagefile and keep them loaded instead. This helps lower pagefile usage and the stupid load times:

1. Launch regedit and drill down to **HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\control\Session manager\memory Management.**

2. Find 'DisablePagingExecutive' and change the value to '1'.

3. In the same key you may come across an entry called 'IoPageLockLimit', which sets a number of bytes aside for the I/O operations. Cranking this value up a notch will improve transfer speeds. (wOOt! Feel the power!) If the value isn't there you can create it as a DWORD and set it to the following:

128MB RAM or less: 8,192.
256MB RAM: 32,768,
512MB RAM or more: 65,535.
Peace out from TwiZTid_CoZa!

Physical RAM operates at speeds your hard drive can only dream of, yet your hard drive is used as virtual memory when your RAM is full. Windows isn't real fussy when deciding what data should be swapped out to your hard drive and your overall performance will depend on what's moved out of system memory. This tweak prevents the system kernel from being swapped to disk and keeps it in RAM, where it best belongs. The second part of the tweak optimises I/O performance for those with lots of file traffic. The tweak itself has been around since early NT days when memory management was certainly not in its prime, but as far as tweaks go, it is still terrifically useful. It won't work for Windows 9x/ME users, however.

Tw33k rating: 7/10

■ TWEAK MY RAVEN

As optimised and tweaked by the developers as it is, Rainbow Six: Raven Shield still has some room for improvement.

Go to your ravenshield\system folder and edit the following:

ravenshield.ini

[WinDrv.WindowsClient]

Set 'TextureMaxLOD=12' to '16' for high end cards, such as RADEON 9700s, or to '9' for low end cards such as GeForce2s. This setting will improve game performance at the expense of textures quality. Try different values until you find a balance between speed and quality.

[D3DDrv.D3DRenderDevice]

Set 'UseVSync' to 'FALSE'; you should see an improvement in your frames per second at the expense of screen 'tearing', caused when your system renders frames faster than the monitor can refresh. If your video card drivers are enforcing vsync, this won't have an effect.

[Engine.GameEngine]

Give 'CacheSizeMegs' a value of '128' if you have a reasonably high-spec system.

[EnginePlayer]

'ConfiguredInternetSpeed' allocates a set amount of Internet bandwidth to the game. The Default is 20,000b/s. If you're on a 56K connection, set this somewhere between 3,000 and 5,000 depending on your actual connection speed. Cable and ADSL players could set this anywhere between 8,000 and 25,000. For LANs, go for a value of 250,000.

If you notice crap performance (serious lag/packet loss), try different values. Extremely high or low values will degrade network performance.

DARE.ini

[Renderer DS3D Options]

Set 'DS3D_CACHE_SIZE' to '6291456', increasing the cache from 2MB to 6MB. This also increases in-game performance.

How's my driving? Does Phr33x Tw33x suck arse? Send me some feedback (or your best uber tweaks) to phr33xtw33x@atomicmpc.com.au.

■ GET YOUR PRIORITIES RIGHT

In a 2K/XP environment you can improve overall performance by adjusting the application's priority class. Available options include: 'Low'; 'Below normal'; 'Normal'; 'Above normal'; 'High' and 'Real time'. The higher the value the better the application performs at the detriment of other processes. Processes critical to your OS could be pushed to the background by the priority of others, so setting anything to a real time priority isn't recommended.

You can do this within Task Manager and right clicking on the process you want to adjust (the application needs to be running).

Alternatively, you could create a batch file that contains the text 'Start /<priority class> <path><filename>' where <class> is one of the previously mentioned states, and <path><filename> specifies the executable to be run.

Using Raven Shield as an example, open notepad and type in the following:

start/high ravenshield.exe

Then save the file in the Ravenshield\system folder as raven.bat or similar. If you have any other parameters which execute as command line options, you can include them in that batch file. Then create a shortcut for your new batch file and execute it instead of your original game shortcut.

Our test system saw an improvement of around 12 to 15 frames per second as a result. wOOt!

日台灣科

The Soggy Polymer Project

Ron Prouse makes a clear case – in the sense that if you're determined, you can make something equally see-through. Check out his work and you could win his creation! See *page 96* for details.

When it came to quantifying extremes my grandfather used to have this saying 'It helps to understand the difference between scratching your bum and tearing yourself a new arsehole.' Clear acrylic cases are an example of the latter. You want a case window? Here's a case window mod that re-defines the meaning of visible components.

This Modjitsu is a little different to the usual as it's part review, part assembly and part modding. The idea is to show off some products, explore the uses they can be put to, and then combine all of the elements into a completed project. A project that might become your very own!

The concept of a 'see-thru' case is nothing new, but only recently has it been possible to buy a good quality acrylic case that is assembled 'off of the shelf' – albeit with some disclaimers regarding the possibility of Electro-Magnetic Interference (EMI) affecting the end user.

It's the perfect vehicle if you want to show off yet another new-release product, the WaterChill liquid-cooling kit from Asetek – the same people who manufacture the VapoChill PC refrigeration units.

When these two components are combined, along with some gentle modding and effective lighting, the result is a show-piece case that not only looks great but has the performance pedigree to match.

PLASTIC AND WATER

As usual, the raw materials that made this project possible are testament to the generosity of several suppliers. These companies regularly 'give something back' to the *Atomic* community, so remember that supporting those who support your hobby is good karma!

AusPC Market (www.auspcmarket.com.au) – Topower 550W PSU. Quiet, good looking and very nice!

PC Case Gear (www.pccasegear.com) – Acrylic case; ThermalTake duct-mod; Perspex grills; LED fans; CCFL tubes; and LaserLEDs

PC Range (www.pcrange.biz) – Asetek WaterChill liquid-cooling kit and RheoBus.

The prices for individual components are available on the individual supplier's Websites. However, the total cost was over (RRP) $1,000.
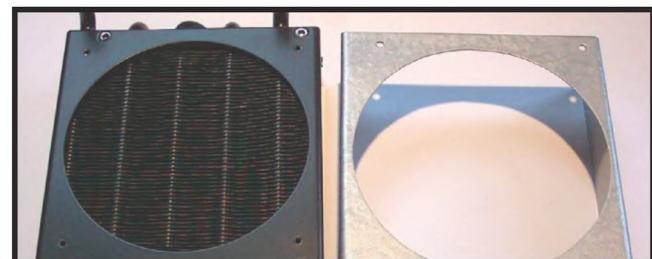
**2** Watch out for hoses facing the wrong direction.

The first mod was an additional radiator shroud, required so the radiator core can be mounted to the top of the case with the fan underneath – the WaterChill radiator is actually designed to be on its 'side', so if it was mounted using the fan-holes then the hose connections would be facing the wrong direction!
Sheet steel, 1.5mm thick, was folded into shape, a 120mm hole was cut for airflow and hammer-tone silver paint applied.

The case came with all the screws required to assemble the average PC, the reason soon became obvious – each is around 5mm longer than 'standard' because they have to pass through the thicker case. Mounting spacers were supplied for the 3.5in drives and brass 'buttons' with O-rings were used to attach the faceplates. The starting point will be water-cooling.

1 Thicker equals longer.

■ BEWARE OF SCREWING COPPER CABLES.

3 The original rivets were drilled out, and the radiator reassembled with the new shroud attached using the original mounting points. Aluminium grill was sandwiched between the two surfaces to protect the exposed copper fins, and the mounting holes tapped to accept 4mm screws. The holes have been offset slightly to avoid the possibility of accidentally screwing into the Copper tubes.
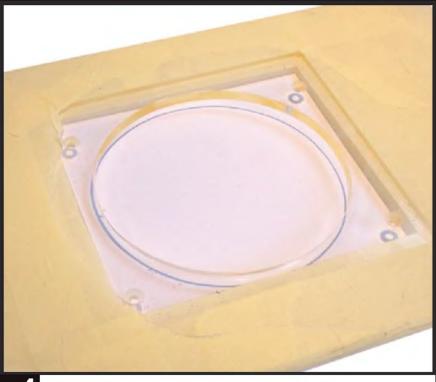
4 Masking tape prevents scratches.

5 Brasso to polish acrylic?

6 Leave the hole rough for better grip.

With the mounting points determined, the case top was removed and covered with masking tape to protect it from scratching during the cutting process.
A jigsaw was used to cut out the hole slightly smaller than required, with #120-grit sandpaper used to remove the last of the excess. To stop the hole from becoming elongated, the sandpaper was wrapped around a sanding-block made from 100mm PVC water pipe.

Once the blow-hole was the correct size, the cut edge was sanded down with increasingly finer grades of Wet'n'Dry sandpaper, the final finish achieved with #1200-grit using Brasso metal polish as the lubricant. As long as all of the imperfections are sanded out, this last step will achieve a 'glass-edge' similar to the original cast-acrylic finish of the case. Used gently on a soft cloth, Brasso is also a good medium to remove any residual stickiness from the masking tape adhesive.

The WaterChill pump and reservoir are usually assembled as one unit. However, this makes it harder to find a suitable mounting space. So it was decided to separate them and a new reservoir mounting bracket was fabricated from an acrylic off-cut.
The process used was identical to that for the top blow-hole, but this time with the hole in the centre left slightly rough so that it had some grip for a press-fit.

7 Remotely mount the cooling reservoir.

8 Try to minimise cables in the case.

9 Minimise noise with an internal fan.

The reservoir was mounted at the rear of the case, out of the way of the expansion slots so it can be easily removed for maintenance. Remote placement also has the added advantage of having an increased liquid volume within the cooling system – the coolant in the connector hose is 50% of the reservoir volume.
The reservoir is also been placed directly behind the two side-cover fans for better heat dispersion.

The controller unit for the 700L/h Hydor water-pump was placed above and behind it to minimise the amount of 240V cable running through the case.
The controller uses a 12V-relay to remote-switch the mains power supply for the pump – provided by a PSU pass-through cable – and also controls the 120mm radiator fan at 12 or 7 volts.
A standard floppy-drive lead supplies the 12V power for the controller.

The final step of setting up the interior components was the positioning of the front fan. As the pump was located directly behind the OEM placement, the fan needed to be off-set toward the right. The answer was to use two ThermalTake duct mods assembled to form an 'S'-bend with an 80mm LED fan and grill at the inner end. The bezel end was left open to give it a unique look and to provide excellent air-flow. Placing the fan inside the case also helps minimise noise.
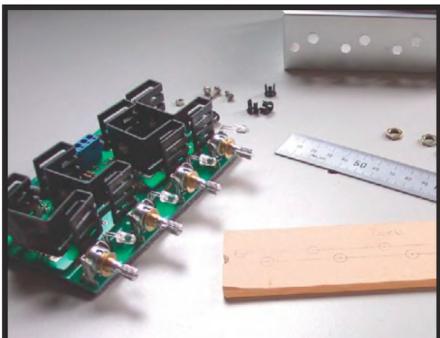
10 The opaque face plates had to go.

With the cooling components located, it was time to start on the front bezel. The decision was made to 'expose' as many of the components as possible – to give the case a 'skeletal' look. A four-channel Rheobus was the first victim. The original Aluminium face-plate was removed, and all of the dimensions transferred onto a clear face-plate. To avoid chipping the acrylic, the holes were first drilled half-way through from one side, and then all the way through from the other.

11 Time to fit the light switches.

Another face-plate was fabricated for the light switches. Holes 19mm in size were drilled and slots filed-out for the locating pins to sit in.
An acrylic 'plate' was cut to size and located behind the switch panel, as a shelf for the cathode inverters and power connectors for the lighting.
The lip of the shelf was left to protrude just under the edge of the top fan to promote airflow over the inverters.
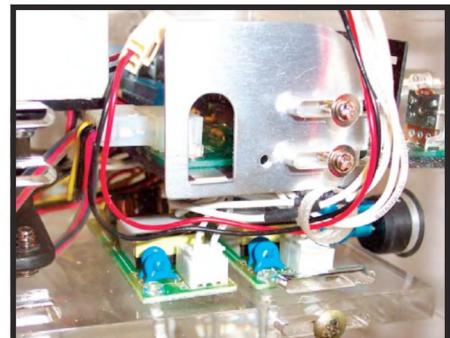
12 Stripped down inverters were added.

A close up of the 'shelf' panel shows the inverters removed from their enclosures in order to add to the stripped-down look of the case components.
The inverter PCBs were screwed to the acrylic to help insulate the areas of higher voltage than cold cathodes run on.
19mm holes were drilled on each side of the drive rails so that the wiring for the lights and rear fans were easier to conceal from view.
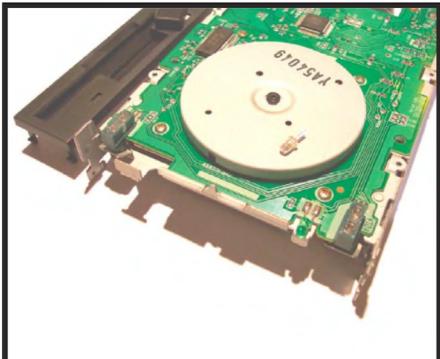
13 Beautify your floppy.

A standard beige floppy drive was stripped and the bezel painted black with vinyl dye. The LED was then replaced with a high-intensity blue one.
Replacing the green LED was simply a matter of using a soldering iron to melt the connector pads, cutting the new LED legs to length and re-soldering them into place, making sure the polarity is correct. Simple. While apart, it was a good opportunity to paint the floppy drive body with hammer-tone silver paint.
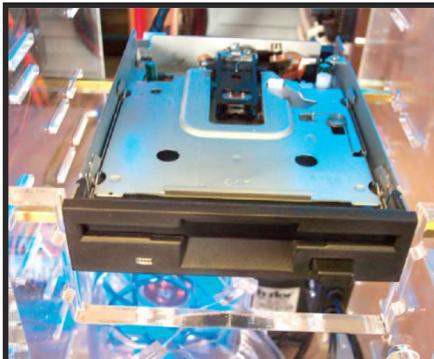
14 They looked flimsy, but do the job.

The finished FDD was installed using the brass spacer / locater screws provided with the case.
Although they initially looked a bit 'flimsy', they actually worked extremely well.
The same screws are used to locate HDD units in the drive rails, and the major positive has to be the amount of air circulation provided.
For this project the FDD had its upper cover left off to again complement the overall 'see-thru' theme.
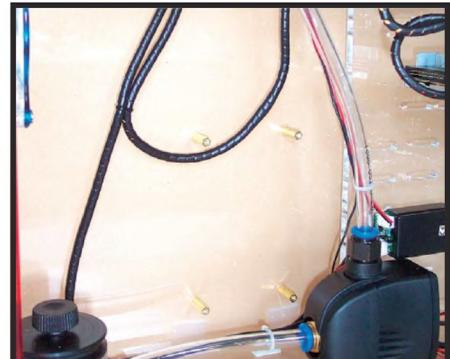
15 The art of hiding wires.

Next question: where to hide all of the wiring? The Topower PSU comes with three separate 'runs', but I have only used two of them – one for the lights and the optical drives and a separate one for the WaterChill controller. That leaves the third for the storage drives.
All of the looms have been covered with wire wrap, and placed so that the mobo will conceal most of their length. Other wires were concealed behind the water-cooling tubing and around the radiator shroud.

There are two groups of polymers: thermoplastics and thermosets. Thermoplastics are in everyday stuff, including bottles, kettles, computer cases and knife handles. They lose their shape fairly easily when heated. Thermosets, on the other hand, are durable, strong and heat-resistant. So they're used in tanks. Obviously.

16 Eight anchor points means easy access.

17 Quick get a protractor. . . 90° angles.

The top, blue cathodes are mounted directly to the case, and the wiring for the rear fan and red cathodes attached to the inside of the blue tubes.

Of note, the square acrylic block next to the awesome gold-series Topower PSU is one of eight that hold the whole case together. This method of assembly means that every external panel can be easily removed from the rest of the case, making it easy to work on for modding.

A rear-view of the 'almost complete' project case shows just how good 'totally square lines' can look.

The illusion of an acrylic case can be unnerving, too; several times I tried to fasten a screw, only to hit my hand on a panel that my eyes hadn't focused on! The placement of the coolant reservoir at the back of the case had a positive attribute that wasn't planned – no excuse for low coolant levels when it is this easy to check!
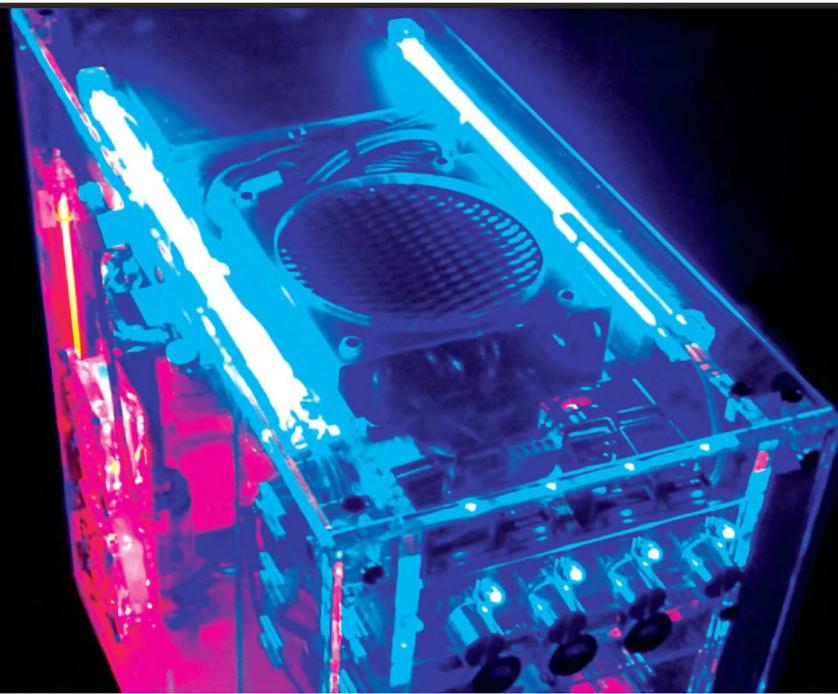
18 The finished product in all it's glowy glory.

The final cleaning and assembly complete and the lights powered up. Although not a 'large' midi-tower – it's smaller than a Lian Li PC-6X – careful positioning of the water-cooling components has resulted in two usable 5.25in bays, spots for two HDDs, and a full-size '9-hole' mobo will fit easily.

Case ventilation is excellent with three 80mm inlets and single 80mm exhaust case fans, all of which are variable speed via the Rheobus – plus the two 80mm PSU exhausts and 7V / 12V 120mm radiator exhaust fan.

The case lighting is used to illuminate the 'outer edges' of the case, so there is a glow over the full bezel area and radiator blow-hole that accentuates the water-cooling and creates the desired 'skeletal' look.

atomic gear

Be fully *Atomic*. Literally. With this page of goodies, you can equip yourself to face the onslaught of LANs and social engagements involving tea. Fear the Stash Master.

→ ATOMIC TOOLKIT
With screwdrivers, allen keys and pliers, what more could you possibly want? $29.95; Subscriber price $27.95

→ ATOMIC MUG
If you've ever put liquid into a cup other than this mug, you should get one. Now. $10.95; Subscriber price $8.95

→ ATOMIC CD STASH MASTER
Rather than let them collect on your floor, slip your CDs into this lovely disc holder. $14.95; Subscriber price $12.95

→ ATOMIC STOCKPILE
All issues in a vault: Good. All issues in an *Atomic* Stockpile binder: Superific. $16.95; Subscriber price $14.95

Item	Quantity	Amount
Atomic Toolkit		$
Atomic CD Stash Master		$
Atomic Stockpile		$
Atomic Mug		$
Delivery charges (plus P+H): 1 item = $10; 2+ items = $15		$

Total		**$**

All prices include GST

Subscriber number:
Email:
Surname: Mr/Mrs/Miss/Ms
First name:
Address:
Suburb: Postcode:
Country:
Phone: (   )   Fax: (   )

✔ Please tick method of payment

☐ Cheque/Money order
Make payable to *Atomic* Magazine and post with this coupon to:
Atomic, Reply Paid 479, North Sydney NSW 2059, or fax (credit card only) to (02) 9492 7399

☐ Bankcard   ☐ MasterCard   ☐ Visa

Card expiry date: ☐☐ / ☐☐

Card no.: ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Cardholder's name:

Signature:

Date:

PHOTOCOPY THIS YOU FOO!!!
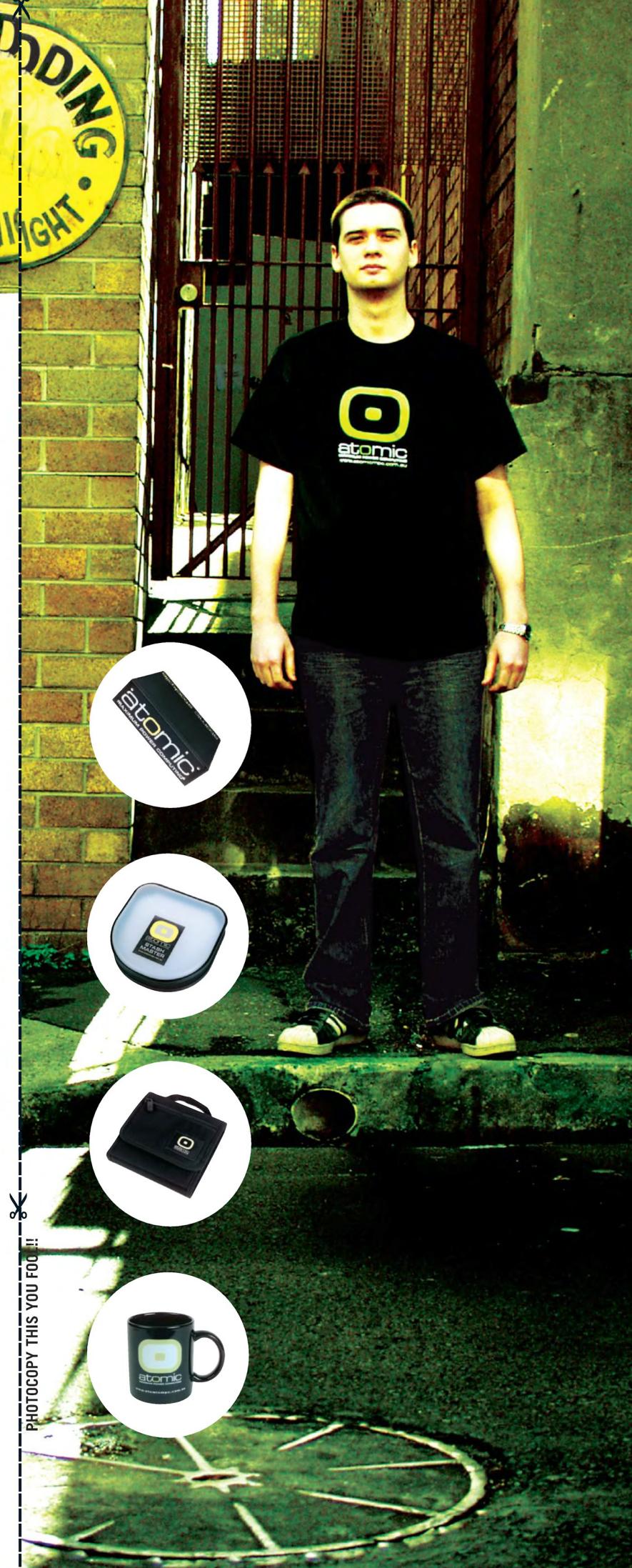
Complicity

Competition news, issue one: You can only enter once per competition or you'll be disqualified. You must provide a postal address for prize delivery when you enter (not PO Box).

⊙ Rise of Nations

This game is really, really good. We've all been playing it and loving it. Will Ben ever stop smashing us into the dust like a Sumo guy passing out and hitting the talcum? Not likely! Microsoft has even produced a full-colour manual for the game – so even if it sucked, you wouldn't realise straight away! Sneaky buggers, luckily the game combines the thrill of fast-paced RTS action with little peasants farming wheat. All the game really needs is Neo and Trinity – but no games have them, not even *The Matrix* game, so what are we complaining about? Nothing! Just shut up and ask the stupid question already!

Q: Name all the funny Marx brothers to have appeared on the silver screen.

⊙ Flash MX course

In a fun new twist to the comps page – you can win wisdom! From Multimedia Training Services (http://www.mmts.com.au). Here's the juice:
1. The prize winner has the option of attending the course at the MMTS studio in Leichhardt, OR online providing they have broadband connection.
2. The course is not transferable and must be taken on the four scheduled Saturdays.
3. Participation in the course is dependant on the prize winner meeting the course pre-requisites listed on the MMTS Website.

Q: Who set off the bra bomb in *The Simpsons*?

⊙ Jedi Academy

Who wants to be a Jedi? Ok, put your hands down. Not down there, Luke. George Lucas wants you to be a Jedi. So LucasArts has made Jedi Academy. Hell – Big George probably doesn't even know this game is in existence. He's probably unaware of the Darth Vader cup on Brad's desk, too. If we believe Uncle George loves us then he really does. Really.

Activision is tops. So it gave us not just four copies of the new game for PC, but also four exclusive figurines! That means four winners! Wahoo! Thanks George, ya big fluff.

Q: What was the name of William Shatner's LP and what songs were on it?

⊙ ATOMIC SUBSCRIBER PRIZE

▪ XIRO USBDRIVE MP3 PLAYER

To be awarded to a randomly drawn *Atomic* subscriber.
What do you call Zorro in New Zealand? Xiro! Yes, it's black hats meets USB meets beats. Store data and grove to the funky beats as you transport your crucial emergency files as you groove to the beats of the *X-Files*. Hey, it rhymes.

Seen one MP3 player, seen them all? No sir! This baby sports convenience like you wouldn't believe. If you happen to be walking past a PC or lappy which has data you want, being legitimate songs, like, just shove it in the USB port and suck it down. Brought to you by Xiro (www.xiro.com.au). Call them on 1300 30 X-I-R-O.

NUCLEAR MEDICINE

atomic
MAXIMUM POWER COMPUTING
www.atomicmpc.com.au

COMPULSORY GAME OF SKILL FOR COMPETITION:
WHO BUILT THE SOGGY POLYMER BOX?

....

SUB-ATOMIC

Stickers for everyone!
In some parts of the world, the *Atomic* sticker is worth more than the US dollar. Like on your case, for example. Now, you can guarantee yourself a sliver-thin slice of *Atomic* history.
From now on – every *Atomic* subscriber or renewer gets a free *Atomic* sticker! If you've been wanting stickerage as much as you want *Atomic*, the form is below. You know what to do.

NEW PRICES

➔ Subscribe to *Atomic* for one year (12 issues) $59
Save 30% off the regular newsstand price and get a sticker!

➔ Subscribe to *Atomic* for two years (24 issues) $95
Save 43% off the regular newsstand price and get a sticker!

))) Afford more hardware: save yourself some cash!

⊚ Never leave your house again: home delivered!

Newsagent brawling no more: get every issue!

⊚ Gain a sense of *belonging*!

Atomic 29 winner (RADEON 9800 Pro): M. Rogers, Coogee, NSW.

Terms and Conditions of Entry. 1. The promoter is AJB Publishing Pty Ltd (ACN 083 063 914) of Unit 2-5/44-70 Rosehill Street, Redfern NSW 2016. Promotion period is from 9.00am on 16.07.03 until 12.00pm on 20.08.03. 2. Entry is open to residents of Australia and New Zealand. Management and employees of AJB Publishing Pty Ltd and their immediate families, and any advertising, marketing or promotional firms associated with this promotion are not eligible to enter. 3. Enter by posting or emailing forms to AJB Publishing Pty Ltd. 4. The draw will be held at the offices of AJB Publishing Pty Ltd at 5.00pm on 20.08.03. Winners will be notified by mail and published in *Atomic* 33. 5. The prizes are not transferable or exchangeable and cannot be taken as cash. 6. The judges' decision is final and no correspondence will be entered into. 7. The promoter reserves the right to publish the winner's name and suburb for promotional purposes. 8. All entries will become the property of AJB Publishing Pty Ltd.

WHY YES! I WOULD LOVE TO SUBSCRIBE TO *ATOMIC MAGAZINE*.

Australia
☐ 1 year (12 issues) $59
☐ 2 years (24 issues) $95

New Zealand
☐ 1 year (12 issues) $NZ71
☐ 2 years (24 issues)$NZ115

PAYMENT DETAILS

✔ Please tick method of payment
☐ Cheque/Money order
Make payable to *Atomic Magazine* and post with this coupon to:
Australia – *Atomic Subscriptions Department*, Reply Paid 479, North Sydney, NSW 2059
or fax (credit card only) to (02) 9492 7310.
NZ – Mercury Solutions, PO Box 24 013, Royal Oak, Auckland.
or fax (credit card only) to (09) 625 3006.
• Please allow up to 4–6 weeks for your first issue of *Atomic*.
☐ Bankcard ☐ MasterCard ☐ Visa ☐ AMEX
Expiry Date: _ _ / _ _ Card No: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

Cardholder's name:

Signature: Date:
☐ Please tick here if you do not wish to receive future promotional information

PERSONAL DETAILS

Email:
Mr/Mrs/Miss/Ms.
Surname:
First name:
Company name:
Position:
Address:
Suburb: State: Postcode:
Country:
Phone: (   )   Fax: (   )

I WOULD LIKE TO SEND A GIFT SUBSCRIPTION TO:

Mr/Mrs/Miss/Ms.
Surname:
First name:
Company name:
Position:
Address:
Suburb: State: Postcode:
Country:
Phone: (   )   Fax: (   )
Please send my gift subscription to ☐ me   ☐ recipient

Fonophobia

Does the welcome message for *your* phone sound like someone making love? John Simpson's does.

Recently I was sent an SMS by my mobile phone supplier (who will remain nameless – despite being the world's only telco that can't spell the word 'phone'). The SMS said a new voicemail system was now in place, and I had to redo my welcome message.

For someone that chokes at the Macca's drive-thru, setting my voicemail message is like pulling teeth. What should I say? Should I sound cheery and lighthearted, like I've just found twenty bucks in my pants? Should I be business-like, like Bill Gates in a courtroom? Should I just wing it and hope it sounds casual? Oh, my face goes numb just thinking about it.

It turns out I didn't get a choice. After coming home from a jog, my phone began flashing, telling me there was a new message. Dialing up, I was shocked to hear that I first had to enter a new greeting. Foiled! Trying to get my breath, the message I recorded went something like this:

'Hi there (puff). This is John and (huff) you've called his phone.' Stating the obvious – clever. 'I can't take your (wheez) call right now because I'm not here.' Then there's a pause. 'Actually (snort) I may be here, but just. . . umm. . . indisposed.' Oh geez, that was lame. 'Anyway, please (puff) talk after the beep.' Then another pause. Was there going to be a beep? What if it was some other noise, or even a tune? Maybe beeps were being phased out? 'Or after I finish talking. . . which is now. . .'

Then there's a few scratching noises, as I fumble to find the star key, then a curse as I realise it should be the hash.

Of course I could've re-recorded the message, but in my heady state all I wanted was a nice lie down. It's remained that way since (I've noticed a sharp decline in the number of people leaving me a message, so maybe that's not a bad thing).

All of us have some sort of technophobia, be it talking to answering machines, installing RAM without a static strap, or using a toaster in the bath. Technology allows us to perform tasks that would previously have been performed by someone far more skilled. Often, the technophobia comes from knowing you're pretty well screwed without it. As the French would say, it's got you by *le balls.*

I know some people that have a grave fear of not pleasing the Microsoft Office assistant – if it doesn't appear, they think Word is broken and log a service call (versus some people that think Word is broken when it *does* appear). Other folk refuse to turn their optical mouse over, for fear of being blinded. There are even some Atomicans (you know who you are) that panic if their CPU temps rise a little. The temperature gauge becomes a metaphorical squirrel gripper.

Then there's a select few that view technology as something more than a necessity – more like a religion, and they are the evangelists. A recent TV program documented the infamous hackers Electron and Phoenix – two suburban whiz-kids pushing their buttons by. . . umm. . . pushing buttons. They insist the reason they hacked into sites like NASA and Citibank was to simply prove they could – not to steal credit card numbers or give some investigative cop a hernia. Electron claims he would spend 18 hours a day online, and the other six thinking about it.

Like Neo on a bender, these hackers are reviled for their skill at understanding the technology and being able to manipulate it. This is in stark contrast to the majority of the population, who think a video card is something you use in Solitaire.

Here am I, stuck in the middle of both camps. I know what's possible with the technology, but I'm pitifully inadequate at making it work for me.

Like a castrato in a whorehouse, I know exactly what I could be doing, but just don't have the right tools. Even though I know it's terribly un-PC (and I certainly don't condone hacking in itself), I've got to salute guys like Electron. They don't fear the technology – it fears them.

So it's back to me and my voicemail. One day I'll make a really good message and become my own technology hero. Until then, if you hear a voicemail message that sounds like a guy having sex, it's probably mine. Don't worry, it won't cost you a cent to listen to me. Well, except the price of the call.
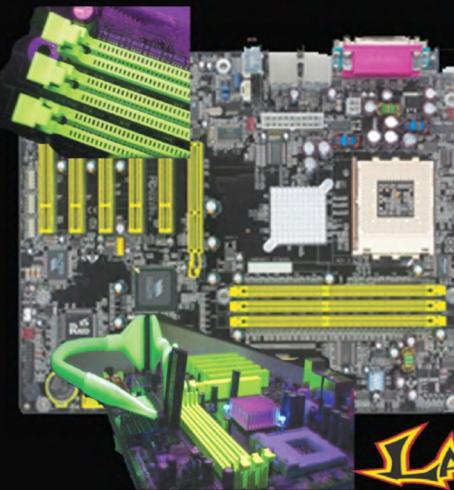

crashtest #4 - If the Matrix Were Real...

DIAL DAMN YOU! DIAL!

TELSTRA WOULD LIKE TO ADVISE THAT THE USER "NEO" HAS EXCEEDED HIS 3GB CAP AND MATRIX TO REAL WORLD ACCESS HAS BEEN RESTRICTED. HAVE A NICE DAY.

Well fruck.

OH, AND LOOK OUT BEHIND YOU.

MAKING IT EA[SY]

Written & Illustrated by Craig Simms. © Copyright 2003 Atomic: Maximum Power Computing

Introducing the new *HydroCool 200* water cooling system from Corsair
The system that brings water cooling to mainstream computer users.

Developed in conjunction with Delphi Thermal Systems, the world leader in water based cooling systems, the HydroCool 200 features real-time temperature displays, visual flow meter with lamp, and a two-stage user defined alarm with automatic PC shutdown. The HydroCool 200 is also the only water cooling kit on the market to include a high quality silver-plated copper water block, which fits both Intel Pentium 4 and AMD XP/MP processors. Using Delphi's patented microchannel technology, the HydroCool 200 provides optimum heat transfer from the CPU, which translates to a faster, safer and more stable computer system - but what else would you expect from an innovative industry leader like Corsair?

"Corsair's CPU water cooling debut is a complete success. The HydroCool200 we tested is intelligently designed, easy to install, well-manufactured and extremely powerful." - tomshardware.com

Please contact Altech Computers to find your nearest retailer.

Sydney
9 Rachael Close, Silverwater NSW 2128
Tel: (02) 9735 5685 Fax: (02) 9735 5656
www.altech.com.au sales@altech.com.au

Brisbane
64 Hope St, South Brisbane QLD 4101
Tel: (07) 3017 2000 Fax: (07) 3017 2020
www.altech.com.au info@altech.com.au

ALTECH
Computers

CORSAIR™

best of tom's 2003
editor's choice
www.tomshardware.com